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THE MOSQUITOES OF THE SUBGENUS *CULEX* IN
SOUTHWESTERN ASIA AND EGYPT (DIPTERA: CULICIDAE)

by

Ralph E. Harbach

Dedicated to

Kenneth L. Knight,

my much admired mentor, colleague and

friend, whose collections made in

Egypt and the Yemen Arab Republic

considerably enhanced this work.

PREFACE

The mosquito fauna of southwestern Asia is limited in taxonomic diversity. Only 98 species are recorded from the region, but at least 25 of these are reportedly involved in the transmission of pathogens that cause malaria, filariasis, and arboviral diseases of importance to man. Epidemiological studies and the control of the associated vectors are extremely limited due to difficulties in making precise species determinations. These difficulties are largely attributed to the absence of up-to-date taxonomic treatments for the various species. This work is a contribution toward defining part of the mosquito fauna of the region. It is a preliminary treatment of the species belonging to the subgenus *Culex*. Its primary objective is to provide modern keys, descriptions, and illustrations for recognizing these species in the adult, pupal, and larval stages.

I consider this work to be preliminary because too few specimens were available to determine the actual distributions and the total range of morphological variation for most of the species. Most of the nomenclatural problems have been solved, but many biosystematic questions require further investigation. The taxonomic status of some forms remains uncertain. Perhaps the greatest contribution of taxonomic study is not in filling gaps in our knowledge about species, but in showing how many gaps still exist. If this manual allows the user to make accurate species determinations, then its primary purpose will be fulfilled. It is my hope that this work will also serve as a basis for further research on the included species.

This report is based on data and observations accumulated at the Walter Reed Biosystematics Unit (WRBU) (housed in the National Museum of Natural History, Smithsonian Institution) between July 1980 and December 1984. The work began as a study of *Culex pipiens* Linnaeus. It was broadened in January 1982 to include all members of the subgenus *Culex* in southwestern Asia and Egypt.

I am indebted to many persons for the successful completion of this manual, and I am most happy to acknowledge their help. I owe much to the stimulating discussions about systematic problems and taxonomic procedures I had with Bruce A. Harrison, E.L. Peyton, Curtis W. Sabrosky, F. Christian Thompson, Michael E. Faran, and Thomas J. Zavortink while we were working together at the Smithsonian Institution. Many individuals have been most generous in loaning specimens or otherwise assisting me with the study of collections under their care: Peter S. Cranston, British Museum (Natural History), London; John Lane, London School of Hygiene and Tropical Medicine; Francois Rodhain, Institut Pasteur, Paris; Jean Clastrier, Museum National d'Histoire Naturelle, Paris; A. Rickenbach, Office de la Recherche Scientifique et Technique Outre-Mer, Bondy; Paul H. Arnaud, California Academy of Sciences, San Francisco; J. Callot, Institut de Parasitologie, Strasbourg; Amnon Freidberg, Tel Aviv University; Joel Margalit, Ben-Gurion University of the Negev, Beer Sheva; M.W. Service, Liverpool School of Tropical Medicine; Thomas Gaffigan and James Pecor, WRBU, National Museum of Natural History, Smithsonian Institution; and staff members of the Dokki Institute and the Entomological Society of Egypt, Cairo. Sherif el Said, Ain Shams University, Cairo, and Joel Margalit (affiliation given above) are especially acknowledged for their special effort in assisting Bruce A. Harrison and myself in collecting a considerable amount of material in Egypt and Israel, respectively, that was examined during the study. All of the illustrations were meticulously and skillfully prepared by Taina Litwak, WRBU. They are a most valuable asset to this work. The entire manuscript was read critically by Ronald A. Ward. His comments and suggestions have resulted in many important improvements. Finally, I warmly acknowledge the con-

stant love and support of my wife Roberta, son Paul, and daughter Andrea who patiently tolerated my use of hundreds of hours of family time to complete this manual.

Bangkok, Thailand
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Ralph E. Harbach

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THE MOSQUITOES OF THE SUBGENUS *CULEX* IN SOUTHWESTERN ASIA AND EGYPT (DIPTERA: CULICIDAE)

by

Ralph E. Harbach^{1,2}

ABSTRACT

Twenty species of *Culex* of the subgenus *Culex* are recognized in southwestern Asia and Egypt: *pipiens* Linnaeus, *quinquefasciatus* Say, *vagans* Wiedemann, *torrentium* Martini, *decens* Theobald, *antennatus* (Becker), *univittatus* Theobald, *perexiguus* Theobald, *theileri* Theobald, *laticinctus* Edwards, *mattinglyi* Knight, *simpsoni* Theobald, *sinaiticus* Kirkpatrick, *duttoni* Theobald, *sitiens* Wiedemann, *poicilipes* (Theobald), *mimeticus* Noè, *bitaeniorhynchus* Giles, *tritaeniorhynchus* Giles, and *pseudovishnui* Colless. Keys, descriptions, and illustrations are provided for the identification of the adult, pupal, and larval stages of each species. Keys are also included for the genera of mosquitoes and the subgenera of *Culex* occurring in the region. The individual treatment of each species also includes a complete synonymy, a summary of previous literature, a systematic discussion, information on bionomics and distribution, and a synopsis of material examined. Lectotype specimens are designated for *decens*, *simpsoni*, *duttoni*, and 16 junior synonyms. A neotype specimen is designated for *bitaeniorhynchus*. Six new junior synonyms are recognized: *alpha* Séguy (= *theileri*); *calloti* Rioux and Pech, *erectus* Iglisch, and *torridus* Iglisch (= *pipiens*); *ethiopicus* Edwards (= *bitaeniorhynchus*); and *mauritanicus* Callot (= *simpsoni*). The recognized species are arranged into three groups and 10 subgroups. The *duttoni* group and the *decens* and *simpsoni* subgroups are recognized for the first time.

¹The opinions or assertions contained herein are the private views of the author and are not to be construed as official or as reflecting the views of the Department of the Army or the Department of Defense.

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INTRODUCTION

The mosquito fauna of southwestern Asia is very poorly known. No modern, comprehensive treatment exists for any group in any part of the region and most of the species descriptions and keys are widely scattered through the literature. There are a number of major works on the mosquitoes of certain countries and specific parts of the region (Edwards, 1921, 1926; Séguy, 1924; Kirkpatrick, 1925; Monchadskii, 1951; Mattingly and Knight, 1956; Senevet and Andarelli, 1959; Gutsevitch et al. 1974), but all of these are limited in scope and treatment, recognize junior synonyms, or include misidentifications or confused species concepts. The majority of the species known to occur in the region were originally described from elsewhere.

This work began in July 1980 as a study of *Culex pipiens* Linnaeus, 1758 in the Middle East. The study was prompted by the alleged involvement of *pipiens* in the 1977 and 1978 epizootics of Rift Valley Fever in Egypt. At that time the concept of *pipiens* in Egypt was confused by the uncertain status of *molestus* Forskål, 1775. It was unknown whether one or more forms identifiable as *pipiens* may have played a role in transmission. In January 1982 a decision was made to expand the study to include all members of the subgenus *Culex* in southwestern Asia. This decision was made in response to the need for up-to-date reliable means of identifying medically important species in this rapidly developing part of the world. The subgenus *Culex* in this region includes a number of actual and potential vector species which could not be identified accurately with existing keys and taxonomic analyses. The decision to expand the study was made at a time when it was becoming apparent that *pipiens* in Egypt was no more than a single behaviorally and physiologically variable species.

Southwestern Asia is defined here as the tract of land south of the USSR between the Mediterranean Sea and the Indus River of Pakistan (Fig. 1). The area includes all of Asian Turkey and the Arabian Peninsula. The eastern part of Pakistan lying along the arid plain of the Indus River is excluded because its mosquito fauna is almost entirely Oriental. Egypt is included in its entirety although only the Sinai Peninsula is actually a part of Asia. All of the species of the subgenus *Culex* found in Egypt west of the Gulf of Suez also occur in parts of southwestern Asia.

The mosquito fauna of the region consists of only 98 species representing seven genera and 18 subgenera (Appendix A). The genus *Culex* is represented by 34 species assigned to seven subgenera. The subgenus *Culex* includes 20 species. Most of southwestern Asia lies within the Mediterranean Subregion of the Palaearctic. The southern part of the Arabian Peninsula belongs to the Afrotropical Region. The majority of the species of the subgenus *Culex* have Palaearctic and Afrotropical affinities. Seven species are clearly Afrotropical, seven Palaearctic, and three Oriental. Three species are broadly distributed in both Asia and Africa.

TAXONOMY

The composition and organization of this section is unusual. It includes all information of taxonomic relevance. Explanatory information is given followed by keys to the genera of mosquitoes and the subgenera of *Culex* in the region. These are followed by a brief taxonomic treatment of the subgenus *Culex*, keys to the species of the subgenus, and the individual species treatments.

Material. The material examined during this study largely came from the collec-

tions of the British Museum (Natural History), the London School of Hygiene and Tropical Medicine, and the National Museum of Natural History, Smithsonian Institution. A large proportion of the material in the National Museum of Natural History came from collections made in Egypt and the Yemen Arab Republic by Kenneth L. Knight (1949-51) and in Egypt by Bruce A. Harrison and myself (1983). Important additional material was examined from the collections of the Institut Pasteur (Paris); Office de la Recherche Scientifique et Technique Outre-Mer (Bondy, France); California Academy of Sciences; Museum National d'Histoire Naturelle (Paris); Institut de Parasitologie, Faculte de Medicine, Universite de Strasbourg (Strasbourg, France); Dokki Institute (Cairo); Entomological Society of Egypt (Cairo); and the personal collections of Amon Freidberg, Tel Aviv University, and Joel Margalit, Ben-Gurion University of the Negev, Beer Sheva. Some 18,600 specimens (5,129 females, 3,703 males, 1,245 male genitalia, 4,220 pupal exuviae, 2,576 larval exuviae, and 1,727 fourth-instar larvae) were examined, including the type specimens of 50 nominal forms. A total of 14,305 specimens (3,571 females, 2,741 males, 874 male genitalia, 3,641 pupal exuviae, 2,123 larval exuviae, and 1,355 fourth-instar larvae) were examined from southwestern Asia. The remainder (1,558 females, 962 males, 371 male genitalia, 579 pupal exuviae, 453 larval exuviae, and 372 fourth-instar larvae) were examined from neighboring areas, mainly in Africa.

Morphology. The morphological terminology recommended by Harbach and Knight (1980) is used throughout this work. No new terminology is introduced. Terms for some details of the male genitalia are taken from Harbach (1986 [1987]) and Harbach et al. (1983 [1984]). The system of lettering the setae borne on the subapical lobe of the male gonocoxite is adopted from Edwards (1941) and Belkin (1962). Siphon indices were calculated using the basal width of the larval siphon. Trumpet indices were determined using the greatest width of the pupal trumpet.

Taxa. The species is the taxonomic unit of primary importance in this study. The species are arranged into groups and subgroups largely for convenience. No subspecies are recognized in this work. Subspecies are largely meaningless biological concepts which have little recognition in modern culicid taxonomy. Most recent workers have either synonymized subspecific names with specific epithets or recognized them for distinct biological species. Users will find that I have followed Sirivanakarn (1976) in considering *Culex quinquefasciatus* Say, 1823 as a species distinct from *pipiens*, even though these forms apparently interbreed in some areas of southwestern Asia. Subspecies are not included among the taxa listed in Appendix A because I believe that discrete populations currently regarded as subspecies in southwestern Asia will eventually prove to be differentiated species.

Keys. Keys are provided for recognizing the adult, pupal, and larval stages of the seven genera of mosquitoes, seven subgenera of *Culex*, and the 20 species of the subgenus *Culex* currently known to occur in southwestern Asia. The keys were prepared especially for the limited fauna of the region (Appendix A) and some species of the included genera of mosquitoes and subgenera of *Culex* from other areas will not key out properly. The keys were prepared for specimens in reasonably good condition. Badly rubbed or damaged specimens will be difficult to identify. The pupal keys for the subgenera of *Culex* and the species of *Culex* (*Culex*) were difficult to prepare and are not as reliable as they appear. Identifications made in the pupal stage should be confirmed in the adult and larval stages when possible. The keys for adults were prepared for both males and females. Keys are not included for the male genitalia. Such keys are normally difficult to use, especially for *Culex*, and more often than not genitalia are identified by comparing dissections with published figures. Detailed descriptions

and illustrations are provided in lieu of cumbersome keys for the male genitalia.

Species treatments. The format of the species treatments is traditional. A complete synonymy is given for each species followed by a summary of previous work, detailed descriptions of the adult, pupal, and larval stages, a systematic discussion, information on bionomics and distribution, and a synopsis of material examined. A cross (+) preceding type data in the synonymies indicates that the type specimen or specimens of the associated nominal taxon were examined. Exceptionally long synonymies are included as appendices. References to previous taxonomic works are exhaustive for the region. Some ecological papers and most major taxonomic analyses for the included species in neighboring geographic areas are also included. The references are listed in chronological order under the biomen, triomen, or other combination used by the authors. Most of the abbreviations used in the synonymies and literature summaries are self-evident. The letters A, M, F, P, L, and E indicate adult, male, female, pupa, larva, and egg, respectively. An asterisk (*) after one of these letters indicates that at least part of the life stage was illustrated in the publication cited. Abbreviations used for type depositories follow the end of this paragraph. The species descriptions include a brief diagnosis for each life stage. All measurements and counts are based on at least 10 specimens from southwestern Asia, when available. Diagnostic characters were checked in most of the positively determined specimens on hand. The chaetotaxy of the immatures was studied using a differential interference contrast microscope. Tables are included which summarize the complete chaetotaxy of the pupa and fourth-instar larva of each species. The names of localities given in the material examined sections were taken from the labels accompanying the specimens. For the most part, no attempt was made to determine the modern spellings of the names.

Type depositories. BC - Bigot Collection (in the collection of J.E. Collin, New Market, Great Britain); BM - British Museum (Natural History), London, Great Britain; DI - Dokki Insitute, Cairo, Egypt; ESE - Entomolgical Society of Egypt, Cairo, Egypt; HNM - Magyar Nemzeti Muzeum, Budapest, Hungary; IPS - Institut de Parasitology, Faculte de Medicine, Universite de Strasbourg, Strasbourg, France; MM - Macleay Museum of Natural History, University of Sydney, Sydney, Australia; MNHP - Museum National d'Histoire Naturelle, Paris, France; NMM - National Museum of Victoria, Melbourne, Australia; NMNH - National Museum of Natural History, Smithsonian Institution, Washington, DC, USA; NMW - Naturhistorisches Museum Vienna, Austria; TMRI - Taiwan Provincial Malaria Research Institute, Nankang, Taipei County, Taiwan; TMS - Tomsk Malaria Station, Tomsk, Siberia, USSR; US - School of Public Health and Tropical Medicine, University of Sydney, Sydney, Australia; ZM - Zoologisches Museum der Humboldt Universität, Berlin, East Germany; ZMC - Universitetets Zoologiske Museum, Copenhagen, Denmark.

Illustrations. The illustrations are original. Drawings are included for the male genitalia, pupa, and larva of each species. Special features of the adult ornamentation of some species are illustrated on a single plate. Structures of the male genitalia are illustrated in a manner consistent with the standard arrangement and positioning adopted in my earlier works (Harbach, 1985b, 1986 (1987); Harbach et al., 1984, 1985). This arrangement includes the mesal aspect of the gonocoxopodite, the dorsal aspect of the intact phallosome, lateral and mesal aspects of the fused lateral plate and aedeagal sclerite, and dorsal aspects of the proctiger and tergum IX. The pupal and larval stages are illustrated in the traditional manner.

KEYS TO GENERA OF CULICIDAE

(Not treated further except for *Culex*)

ADULTS

1. Maxillary palpi of female about as long as proboscis; scutellum evenly rounded; abdominal scales largely or completely absent **Anopheles**
Maxillary palpi of female much shorter than proboscis; scutellum distinctly trilobed; abdomen completely covered with scales 2
- 2(1). Cell R2 of wing shorter than vein R2+3; wing membrane without distinct microtrichia **Uranotaenia**
Cell R2 at least as long as vein R2+3; wing with distinct microtrichia 3
- 3(2). Spiracular setae present; wing with setae present ventrally at base of subcosta **Culiseta**
Spiracular setae absent; subcosta without setae present ventrally 4
- 4(3). Tarsomere 1 of fore- and midlegs distinctly longer than tarsomeres 2-5 combined; tarsomere 4 shorter than tarsomere 5 **Orthopodomyia**
Tarsomere 1 no longer than combined length of tarsomeres 2-5, usually shorter; tarsomere 4 longer than tarsomere 5 5
- 5(4). Postspiracular setae present; foreungues toothed. **Aedes**
Postspiracular setae absent; unguis simple 6
- 6(5). Hindungues large and conspicuous; pulvilli absent **Coquillettidia**
Hindungues small and inconspicuous; pulvilli present **Culex** (p. 7)

PUPAE

1. Seta 9-IV-VII spiniform, arising at or near extreme posterolateral corner of tergum; trumpet short, flared, meatus with broad slit extending nearly to base **Anopheles**
Seta 9-IV-VII weakly developed, arising distinctly before posterolateral corner of tergum; trumpet otherwise, meatus at most with narrow slit extending a short distance from pinna 2
- 2(1). Trumpet without pinna, apex modified for piercing plant tissues **Coquillettidia**
Trumpet with distinct open pinna 3
- 3(2). Inner part of paddle deeply excavated toward base, distinctly widened near middle **Uranotaenia**
Inner part of paddle little if at all excavated toward base, slightly widened (usually in distal third) 4

- 4(3). Tracheoid area of trumpet well developed, extending a considerable distance from base; seta 2-P usually present **Culex** (p. 8)
Tracheoid area absent or at most weakly developed at extreme base; seta 2-P absent 5
- 5(4). Seta 9-VIII strongly developed, about 0.5 length of paddle; paddle somewhat rectangular with buttress distinctly ending beyond middle of outer margin; seta 1-P branched **Orthopodomyia**
Seta 9-VIII not as well developed; paddle more or less ovoid, buttress ending before middle of outer margin; seta 1-P simple 6
- 6(5). Setae 8- and 9-CT in line perpendicular to median keel **Culiseta**
Seta 8-CT distinctly more anterior than 9-CT **Aedes**

LARVAE

- 1. Siphon absent **Anopheles**
Siphon present. 2
- 2(1). Spiracular apparatus at apex of siphon modified for piercing plant tissues, with anterior toothed plate. **Coquillettidia**
Spiracular apparatus unmodified, comprised of 5 lobes, without anterior toothed plate 3
- 3(2). Siphon without pecten **Orthopodomyia**
Siphon with pecten. 4
- 4(3). Head longer than wide; comb scales arising from a sclerotized plate **Uranotaenia**
Head at least as wide as long; comb plate absent, scales arising from unsclerotized integument 5
- 5(4). Siphon with at least 3 pairs of seta 1-S, usually more **Culex** (p. 8)
Siphon with a single pair of seta 1-S 6
- 6(5). Seta 1-S arising near base of siphon. **Culiseta**
Seta 1-S arising near last pecten spine in middle part of siphon **Aedes**

KEYS TO SUBGENERA OF *CULEX*(Not treated further except *Culex*)

ADULTS

1. No lower mesepimeral setae; proboscis with pale ring in middle **Culex** (in part, p. 13)
One or more lower mesepimeral setae; proboscis either entirely dark or pale beneath 2
- 2(1). Three or more lower mesepimeral setae and prealar scales present; occurring in southern part of Arabian Peninsula **Lutzia**
One to 4 lower mesepimeral setae present; prealar scales present or absent; normally no prealar scales if 3 or 4 lower mesepimeral setae are present 3
- 3(2). Proboscis shorter than forefemur; hindtarsomere 1 short, not more than 0.85 length of hindtibia **Barraudius**
Proboscis longer than forefemur; hindtarsomere 1 usually as long or only slightly shorter than hindtibia, not less than 0.85 length of hindtibia 4
- 4(3). Abdominal terga with basal pale bands or basolateral pale spots (lateral pale stripes on terga VI and VII in *antennatus*). **Culex** (in part, p. 13)
Abdominal terga with apical pale bands, apicolateral pale spots or entirely dark 5
- 5(4). Decumbent scales of vertex mainly narrow and dark, those on ocular line broad and white; scutal scales entirely dark and very fine; occurring in southern part of Arabian Peninsula **Culiciomyia**
All decumbent scales of vertex narrow and pale; scutal scales predominantly pale and rather coarse (except in *Neoculex martini*) 6
- 6(5). Prealar, and usually postspiracular, scales present **Maillotia**
Prealar and postspiracular scales absent 7
- 7(6). Small yellowish-brown species; apical markings of abdominal terga yellowish and indistinct against pale brown background; maxillary palpi of male shorter than proboscis **Lasiosiphon**
Larger, darker species; apical markings of abdominal terga white and well contrasted against black or nearly black background; maxillary palpi of male longer than proboscis **Neoculex**

PUPAE

1. Seta 6-III-VI usually all single 2
Seta 6-III-VI usually all branched (except sometimes *duttoni*) 5
- 2(1). All or most of setae 1-9-CT single; seta 9-VIII well removed cephalad
from caudolateral angle of tergum, about 0.7 from base **Lutzia**
All or most of setae 1-9-CT branched; seta 9-VIII immediately
adjacent to caudolateral angle of tergum 3
- 3(2). Seta 5-CT very long, longer than trumpet; paddle distinctly
notched at tip **Culiciomyia**
Seta 5-CT short; paddle evenly rounded or only slightly
notched at tip 4
- 4(3). Trumpet short and broad, length less than 0.6 mm, index about
3.0; setae 1-IX and 2-P absent **Lasiosiphon**
Trumpet longer, length normally more than 0.6 mm, index more
than 3.0; setae 1-IX and 2-P usually present **Culex** (in part, p. 17)
- 5(1). Seta 5-V,VI at least nearly as long as 2 terga following, usually
as long, sometimes longer 6
Seta 5-V,VI 1.5 or less length of tergum following (except in
duttoni), usually less 7
- 6(5). Trumpet long and slender, index more than 7.0; seta 1-P not
much stronger than 2-P, about twice as long **Neoculex**
Trumpet not as long and slender, index less than 7.0; seta 1-P
clearly stronger than 2-P, about four times as long **Maillotia**
- 7(5). Trumpet short and broad, length less than 0.6 mm, index
about 4.0 **Barraudius**
Trumpet variable, length and index usually more than indicated,
if length less than 0.6 mm then index more than 4.0 **Culex** (in part, p. 17)

LARVAE

1. Lateral palatal brushes developed for predation; saddle longer than
siphon; pecten extending to apex of siphon **Lutzia**
Lateral palatal brushes developed for filter-feeding; saddle shorter
than siphon; pecten not extending to apex of siphon. 2
- 2(1). Ventral brush (seta 4-X) with 4 pairs of setae; antenna shorter than
0.5 length of head; siphon with lateral pair of transversely-
aligned setae adjacent to pecten **Culiciomyia**
Ventral brush with 5 or more (usually more) pairs of setae; antenna
longer than 0.5 length of head; siphon without lateral pair of
transversely-aligned setae 3

- 3(2). Setae 5,6-C very short and inconspicuous, about same thickness
and length as seta 4-C **Lasiosiphon**
Setae 5,6-C long and conspicuous, much thicker and longer than
seta 4-C 4
- 4(3). Ventral brush with 1 or more setae borne anterior to grid 5
Ventral brush with all setae borne on grid 6
- 5(4). Seta 3-P nearly length of setae 1,2-P; siphon with 2 or more
(usually more) anterolateral setae on each side; seta 1-S
unpaired, occurring in single median posterior row **Maillotia**
Seta 3-P much shorter than 1,2-P, about 0.5 as long; siphon
without anterolateral setae; seta 1-S more or less paired,
occurring in 2 posterolateral rows **Neoculex**
- 6(4). Seta 1-S in single row, with all elements arranged in more or less
straight line **Barraudius**
Seta 1-S in 1 or 2 rows, with 1-3 elements distinctly out of line with
the others (inserted laterally) **Culex** (p. 19)

Genus **Culex** LinnaeusSubgenus **Culex** Linnaeus

- Culex** Linnaeus, 1758: 602. Type species: *pipiens* Linnaeus, 1758: 602 (subsequent designation, Latreille, 1810: 442).
- Heteronychia** Lynch Arribalzaga, 1891a: 373; 1891b: 155. Type species: *dolosa* Lynch Arribalzaga (monotypy).
- Lasioconops** Theobald, 1903a: 236. Type species: *poicilipes* Theobald (monotypy).
- Heptaphlebomyia** Theobald, 1903a: 336. Type species: *simplex* Theobald (monotypy).
- Pseudoheptaphlebomyia** Ventrillon, 1905b:427. Type species: *madagascariensis* Ventrillon (monotypy).
- Trichopronomyia** Theobald, 1905b: 98. Type species: *annulata* Theobald (monotypy).
- Aporoculex** Theobald, 1907: 316. Type species: *punctipes* Theobald (monotypy).
- Leucomyia** Theobald, 1907: 372. Type species: *gelidus* Theobald (original designation).
- Oculeomyia** Theobald, 1907: 515. Type species: *sarawaki* Theobald (monotypy).
- Theobaldiomyia** Brunetti, 1912: 462. Type species: *Culex gelidus* Theobald, 1901a: 20 (fixed type of a replacement name).
- Phalangomyia** Dyar and Knab, 1914: 58. Type species: *debilis* Dyar and Knab (monotypy).
- Laiomyia** Izquierdo, 1916: 65. Type species: *Culex stigmatosoma* Dyar, 1907: 123 (subsequent designation, Edwards, 1932a: 200).
- Culex** subgenus **Transculicia** Dyar, 1917(1918): 184. Type species: *eleuthera* Dyar (monotypy).
- Culex** subgenus **Cacoculex** Dyar, 1918: 100. Type species: *habilitator* Dyar and Knab, 1906: 212 (original designation).

The subgenus *Culex* is a large and diverse group with more than 200 species which are distributed throughout the world. The concept of the subgenus defined by Edwards (1932a, 1941), Belkin (1962), Bram (1967a), Sirivanakarn (1976), and Tanaka et al. (1979) is followed here although this concept will probably change once the phylogenetic relationships of the species are understood. These authors have adequately diagnosed the subgenus and it does not need to be characterized here.

The subgenus *Culex* in southwestern Asia is represented by 20 nominal species which fall into three groups and 10 subgroups. The groups, subgroups, and species are arranged and treated in the order indicated in the chart below. The species and subgroups, with the exception of the *trifilatus* subgroup, are arranged chronologically within their respective higher categories. The species are placed in subgroups based on presumptive phylogenetic relationships. I have made no special effort to determine natural affinities and little is said or conjectured about evolutionary relationships between species or groups of species. My primary aim has been to provide a strong descriptive base for the identification and future study of each species. The supraspecific groups are not described. They are adequately defined by the shared characters noted for the included species.

Linear Arrangement of Included Taxa

- pipiens* group** (Edwards, 1932a: 201; excluding *duttoni* Theobald)
- pipiens* subgroup (Sirivanakarn, 1976: 29)
- 1) *pipiens* Linnaeus, 1758 (p. 23)
 - 2) *quinquefasciatus* Say, 1823 (p. 31)
- trifilatus* subgroup (Mattingly and Rageau, 1958: 241)
- 3) *vagans* Wiedemann, 1828 (p. 36)
 - 4) *torrentium* Martini, 1925 (p. 40)
- decens* subgroup (New Subgroup)
- 5) *decens* Theobald, 1901c (p. 44)
 - 6) *antennatus* (Becker, 1903) (p. 48)
- univittatus* subgroup (Sirivanakarn, 1976: 47)
- 7) *univittatus* Theobald, 1901b (p. 52)
 - 8) *perexiguus* Theobald, 1903a (p. 57)
- theileri* subgroup (Sirivanakarn, 1976: 43)
- 9) *theileri* Theobald, 1903a (p. 61)
 - 10) *laticinctus* Edwards, 1913a (p. 67)
 - 11) *mattinglyi* Knight, 1953b (p. 72)
- simpsoni* subgroup (New Subgroup)
- 12) *simpsoni* Theobald, 1905c (p. 75)
 - 13) *sinaiticus* Kirkpatrick, 1924(1925) (p. 78)
- duttoni* group** (New Group)
- 14) *duttoni* Theobald, 1901c (p. 82)
- sitiens* group** (Edwards, 1932a: 201)
- sitiens* subgroup (*sitiens* series of Edwards, 1932a: 201; including *poicilipes* (Theobald))
- 15) *sitiens* Wiedemann, 1828 (p. 87)
 - 16) *poicilipes* (Theobald, 1903b) (p. 92)
- mimeticus* subgroup (*mimeticus* series of Edwards, 1932a: 201)
- 17) *mimeticus* Noè, 1899 (p. 97)
- bitaeniorhynchus* subgroup (*bitaeniorhynchus* series of Edwards, 1932a: 201, excluding *poicilipes* (Theobald))
- 18) *bitaeniorhynchus* Giles, 1901a (p. 101)
- vishnui* subgroup (Bram, 1967a)
- 19) *tritaeniorhynchus* Giles, 1901a (p. 106)
 - 20) *pseudovishnui* Colless, 1957 (p. 111)

Distributional List of the Species

Too few collections have been made in most areas of southwestern Asia to plot the distributions of the species accurately and completely. Members of the subgenus *Culex* known to occur in the region are listed by country below. The list is compiled from material examined and literature records. Species mistakenly or doubtfully recorded in the literature are not included.

AFGHANISTAN: *Culex perexiguus*, *pipiens*, *quinquefasciatus*, *theileri*, and *vagans*.

BAHRAIN: *Culex quinquefasciatus*.

EGYPT: *Culex antennatus*, *laticinctus*, *mimeticus*, *perexiguus*, *pipiens*, *poicilipes*, *sinaiticus*, *theileri*, and *tritaeniorhynchus*.

IRAN: *Culex antennatus*, *bitaeniorhynchus*, *laticinctus*, *mimeticus*, *perexiguus*, *pipiens*, *pseudovishnui*, *quinquefasciatus*, *sinaiticus*, *sitiens*, *theileri*, *torrentium*, *tritaeniorhynchus*, and *vagans*.

IRAQ: *Culex antennatus*, *laticinctus*, *mimeticus*, *perexiguus*, *pipiens*, *pseudovishnui*, *quinquefasciatus*, *theileri*, *torrentium*, and *tritaeniorhynchus*.

ISRAEL: *Culex antennatus*, *laticinctus*, *mimeticus*, *perexiguus*, *pipiens*, *poicilipes*, *sinaiticus*, *theileri*, and *tritaeniorhynchus*.

JORDAN: *Culex antennatus*, *laticinctus*, *mimeticus*, *perexiguus*, *pipiens*, *sinaiticus*, *theileri*, and *tritaeniorhynchus*.

KUWAIT: *Culex quinquefasciatus*.

LEBANON: *Culex laticinctus*, *mimeticus*, *perexiguus*, *pipiens*, *theileri*, and *tritaeniorhynchus*.

OMAN: *Culex laticinctus*, *perexiguus*, *quinquefasciatus*, *sinaiticus*, *sitiens*, and *tritaeniorhynchus*.

PAKISTAN (west of Indus River): *Culex bitaeniorhynchus*, *mimeticus*, *perexiguus*, *pseudovishnui*, *quinquefasciatus*, *sitiens*, *theileri*, *tritaeniorhynchus*, and *vagans*.

P.D.R. YEMEN: *Culex bitaeniorhynchus*, *decens*, *duttoni*, *laticinctus*, *mattinglyi*, *pipiens*, *quinquefasciatus*, *sinaiticus*, *sitiens*, *theileri*, *tritaeniorhynchus*, and *univittatus*.

QATAR: *Culex quinquefasciatus*.

SAUDI ARABIA: *Culex laticinctus*, *mattinglyi*, *perexiguus*, *pipiens*, *quinquefasciatus*, *sinaiticus*, *sitiens*, *theileri*, and *tritaeniorhynchus*.

SYRIA: *Culex laticinctus*, *mimeticus*, *perexiguus*, *pipiens*, *theileri*, and *tritaeniorhynchus*.

TURKEY: *Culex antennatus*, *laticinctus*, *mimeticus*, *perexiguus*, *pipiens*, *theileri*, *torrentium*, *tritaeniorhynchus*, and *vagans*.

UNITED ARAB EMIRATES: *Culex pipiens*, *quinquefasciatus*, and *sitiens*.

YEMEN ARAB REPUBLIC: *Culex bitaeniorhynchus*, *decens*, *laticinctus*, *mattinglyi*, *pipiens*, *quinquefasciatus*, *simpsoni*, *sinaiticus*, *sitiens*, *theileri*, *tritaeniorhynchus*, and *univittatus*.

Zoogeographic Affinities

The Yemen Arab Republic, the P.D.R. Yemen, and the southwestern part of Saudi Arabia belong to the Afrotropical Region. The rest of southwestern Asia and Egypt lie within the southern Palaearctic. The known distributions of the included species can be examined to determine their zoogeographic affinities. *Culex decens*, *univittatus*, *mattinglyi*, *simpsoni*, and *duttoni* are strictly Afrotropical species. All of these species except *mattinglyi* are widely distributed south of the Sahara and occur in the Afrotropical part of the Arabian Peninsula. *Culex mattinglyi* is endemic to southwestern Asia. *Culex antennatus* and *poicilipes* are also widely distributed in sub-Saharan Africa, but they do not occur in the Afrotropical part of Arabia. *Culex poicilipes* extends northward along the Nile River into Egypt and Israel. *Culex antennatus* is common in

lands around the eastern end of the Mediterranean. Seven Afrotropical species are present in the region.

Culex theileri appears to be a southern Palaearctic species which has spread southward through the temperate highlands of eastern Africa and eastward through India. Both *laticinctus* and *sinaiticus* are mainly Palaearctic with limited distributions in the Afrotropical Region. *Culex perexiguus* is very widely distributed across northern Africa and southwestern Asia and extends eastward into the Oriental Region. This species is apparently replaced by *univittatus* in southwestern Arabia. *Culex mimeticus* occurs in a relatively narrow zone which extends from the shores of the Mediterranean, through the Middle East, and beyond. Populations of this species in eastern Asia occur in both the Palaearctic and Oriental regions. *Culex vagans* is widespread in the northeastern Palaearctic. Its known range includes southern China and India in the Oriental Region and northern countries of southwestern Asia. *Culex torrentium* is the only species of the subgenus in southwestern Asia which is exclusively Palaearctic. Its range lies mainly north of southwestern Asia. A total of seven Palaearctic species occur in the region.

Oriental species in southwestern Asia include *sitiens*, *tritaeniorhynchus*, and *pseudovishnui*. *Culex bitaeniorhynchus* perhaps should be included among these species, but its wide distribution in the Oriental Region is offset by its nearly equally broad distribution in the Afrotropical Region. *Culex tritaeniorhynchus* is very widely distributed in southwestern Asia, but the main part of its range lies within the Oriental Region. Isolated populations occur in Egypt and it is known from certain coastal areas of eastern and western Africa where it was probably introduced by man. Both *sitiens* and *pseudovishnui* have limited distributions in the region. The former is a coastal species which extends from the eastern coast of Africa to the South Pacific. *Culex pseudovishnui* is an indigenous member of the Oriental fauna which has spread into the eastern part of the region.

Culex pipiens and *quinquefasciatus* are common widespread sister species whose distributions undoubtedly have been influenced by man. Their natural ranges cannot be known for certain. *Culex pipiens* is very widely distributed in the Palaearctic and eastern areas of the Afrotropical Region. This species may have evolved in Africa and dispersed to more northern latitudes. It is replaced at lower elevations in warmer areas by *quinquefasciatus*. *Culex quinquefasciatus* is cosmotropical.

KEYS TO SPECIES OF *CULEX* (*CULEX*)

ADULTS

1. One or more lower mesepimeral setae present (Fig. 2A) (note presence of alveoli if setae are missing); proboscis and tarsi without pale rings (except *duttoni*). 2
- No lower mesepimeral setae (note absence of alveoli); proboscis with median pale ring; tarsi with narrow pale rings (*sitiens* group) 18
- 2(1). Tarsi with narrow pale rings (*duttoni* group); midtibia with anterior pale stripe (Fig. 2H); postspiracular scales present **duttoni** (p. 82)
- Tarsi without pale rings (*pipiens* group); midtibia with or without anterior pale stripe; postspiracular scales present or absent 3

pipiens group

3(2).	Postspiracular and prealar scales present (Fig. 2A).	4
	No postspiracular scales.	8
4(3).	All tibiae with anterior pale stripes (Fig. 2G); prealar and upper and lower mesokatepisternal scale-patches confluent (Fig. 2B); basal pale bands of abdominal terga produced posteriorly in middle theileri (p. 61)	
	Fore- and midtibiae normally without anterior pale stripes (<i>univittatus</i> and <i>perexiguus</i> usually have an anterodorsal pale stripe on the midtibia); prealar and upper and lower mesokatepisternal scale-patches separate; basal pale bands of abdominal terga not produced posteriorly in middle	5
5(4).	Hindtibia with anterior pale stripe (Fig. 2K); wing with short line of pale scales at base of costa	6
	Hindtibia without anterior pale stripe; wing entirely dark-scaled	7
6(5).	Anterior surface of midfemur with complete narrow pale stripe (Fig. 2I); wing usually with row of scales on vein 2A (a unique character among mosquitoes) (Fig. 2D); occurring in southern part of Arabian Peninsula univittatus (p. 52)	
	Anterior surface of midfemur entirely dark-scaled or with incomplete narrow pale stripe; wing seldom with few scales on vein 2A; occurring throughout southwestern Asia and Egypt perexiguus (p. 57)	
7(5).	Hindfemur with complete or nearly complete anterodorsal dark stripe (Fig. 2L); <u>females</u> : abdominal sterna with apical dark bands; forecoxa with some dark scales; <u>males</u> : abdominal sterna mainly dark-scaled, with basolateral pale spots; maxillary palpus normal simpsoni (p. 75)	
	Hindfemur with anterodorsal dark stripe on distal 0.5 or less (Fig. 2M); <u>females</u> : abdominal sterna usually entirely pale-scaled; scales of forecoxa usually all pale; <u>males</u> : abdominal sterna mainly pale-scaled, posterior sterna usually with dark scales posteriorly; maxillary palpus sparsely setose sinaiticus (p. 78)	
8(3).	Prealar scales present (Fig. 2C)	9
	Prealar scales absent	10
9(8).	Thorax pale; wing with short line of pale scales at base of costa; scales of forecoxa all pale; frequently with 2-4 lower mesepimeral setae laticinctus (p. 67)	
	Thorax darker; wing entirely dark-scaled; forecoxa with some dark scales; normally with only one lower mesepimeral seta torrentium (p. 40)	

- 10(8). Fore- and midfemora and all tibiae with anterior pale stripes
(Fig. 2G) **vagans** (p. 36)
These with anterior surfaces entirely dark-scaled 11
- 11(10). Abdominal sterna with apical dark bands; scutal scales with
distinct reddish tint; occurring in southern part of Arabian
Peninsula **decens** (p. 44)
Abdominal sterna unbanded, dark scales confined to midline
and/or posterolateral corners when present; color of scutal
scales variable 12
- 12(11). Abdominal terga unbanded, terga VI and VII with lateral pale
stripe; proboscis of male with ventral cluster of setae at
false joint **antennatus** (p. 48)
Abdominal terga with basal pale bands; proboscis of male
without ventral cluster of setae at false joint 13
- 13(12). Two to 4 lower mesepimeral setae present (note presence of
alveoli if setae are missing) **laticinctus** (p. 67)
Only one lower mesepimeral seta present 14
- 14(13). Scales of forecoxa all pale; wing with short line of pale scales
at base of costa; proboscis all dark or faintly pale beneath. 15
Forecoxa with some dark scales; wing entirely dark-scaled;
proboscis usually distinctly pale beneath in middle 16
- 15(14). Thoracic integument pale; scutal scales light yellowish brown;
scutum with short diagonal line of whitish scales along
prescutal suture; dorsal dark stripe of hindfemur beginning
beyond base and expanded over distal 0.2-0.3 of anterior
surface **laticinctus**(p. 67)
Thoracic integument and scutal scales darker; scutum with
curved line of pale scales along prescutal suture and
posterior dorsocentral setae; dorsal dark stripe of
hindfemur beginning at base and expanded over
distal 0.3-0.4 of anterior surface **mattinglyi** (p. 72)
- 16(14). Scutal scales more or less buff-colored; basal bands of
abdominal terga nearly white, usually slightly paler than
sternal scaling; females: tergal bands slightly if at all
darker than basolateral white spots, subcosta normally
intersects costa before furcation of R2+3; males: dorsal
arms of phallosome nearly parallel in dorsal aspect
(Fig. 5), DV/D usually more than 0.6*. **quinquefasciatus** (p. 31)

*These characters are unreliable for separating *pipiens* and *quinquefasciatus* in central and northeastern areas of the Arabian Peninsula where introgressed populations (hybrids) occur.

16	Contrib. Amer. Ent. Inst., vol. 24, no. 1, 1988	
	Scutal scales golden brown with reddish tint; basal bands of abdominal terga yellowish, usually same color as sternal scaling; <u>females</u> : tergal bands distinctly darker than basolateral white spots; subcosta normally intersects costa at or beyond furcation of R2+3; <u>males</u> : dorsal arms of phallosome divergent in dorsal aspect (Figs. 3, 9); DV/D usually less than zero*	17
17(16).	<u>Females</u> : cell R2 more than 4.0 length of vein R2+3; integument and scales between supraala and posterior dorsocentral setae usually noticeably darker than surrounding integument and scales, evident as pair of ovoid spots; <u>males</u> : cell R2 2.4-3.6 length of vein R2+3; dorsal arm of phallosome truncate in dorsal aspect, lateral plate without apicolateral spiculate lobe (Fig. 3)	pipiens (p. 23)
	<u>Females</u> : cell R2 less than 4.0 length of vein R2+3; integument and scales between supraalar and posterior dorsocentral setae not appreciably darker than surrounding integument and scales; <u>males</u> : cell R2 2.0-2.5 length of vein R2+3; dorsal arm of phallosome pointed in dorsal view, lateral plate with apicolateral spiculate lobe (Fig. 9)	torrentium (p. 40)
	<i>sitiens</i> group	
18(1).	Wing with pattern of pale spots (Fig. 2E); midtibia with anterior pale stripe (Fig. 2H)	mimeticus (p. 97)
	Wing either speckled, entirely dark-scaled or with variable amount of pale scaling along anterior veins; no anterior pale stripe on midtibia	19
19(18).	Anterior surfaces of femora and tibiae with rows of small pale spots (Fig. 2J); lower proepisternal scales present . . .	poicillipes (p. 92)
	Femora and tibiae without rows of pale spots; lower proepisternal scales absent	20
20(19).	Abdominal terga with apical pale bands; wing with numerous scattered pale scales (Fig. 2F); proboscis with pair of dorsolateral pale spots before labella.	bitaeniorhynchus (p. 101)
	Without these characters.	21
21(20).	Femora with numerous scattered pale scales on anterior surfaces; scutum with indefinite mottled pattern; cell M1 long, furcation of vein M1+2 proximal to furcation of vein R2+3	sitiens (p. 87)
	Without these characters	22

*These characters are unreliable for separating *pipiens* and *quinquefasciatus* in central and northeastern areas of the Arabian Peninsula where introgressed populations (hybrids) occur.

- 22(21). Females: pale ring of proboscis extended proximally on ventral surface*; forked scales of vertex dirty yellow to brown in middle; cell R2 more than 3.0 length of vein R2+3; males: proboscis with ventral cluster of 10 or more setae at false joint; forked scales as in female. **tritaeniorhynchus** (p. 106)
- Females: pale ring of proboscis without proximal extension on ventral surface; forked scales of vertex white to yellow in middle; cell R2 less than 3.0 length of vein R2+3; males: proboscis without ventral cluster of setae (1 or 2 setae sometimes present); forked scales as in female **pseudovishnui** (p. 111)

PUPAE

1. Median area of scutum, metanotum and terga I and II with conspicuous vesicles; seta 5-VI as long as terga VII and VIII combined, usually single (Fig. 29). **duttoni** (p. 82)
- Median area of scutum, metanotum and terga I and II without vesicles; seta 5-VI distinctly shorter than combined length of terga VII and VIII, normally double or triple 2
- 2(1). Seta 8-CT usually with 3 or more branches, seldom double; seta 6-III-VI also usually with 3 or more branches, sum of their branches on one side of abdomen equals 9 or more, usually more 3
- Set 8-CT usually double, rarely single or triple; seta 6-III-VI normally single or double, sum of their branches on one side of abdomen not exceeding 8 14

pipiens group

- 3(2). Seta 6-I,II short, not much longer than 7-I,II; trumpet strongly flared, index normally less than 4.0; tracheoid area short, 0.3 or less of trumpet length 4
- Seta 6-I,II long, at least twice as long as 7-I,II; trumpet not so strongly flared, index normally more than 4.0; tracheoid area long, usually more than 0.3 of trumpet length 5
- 4(3). Seta 6-I single or double; seta 5-II with 4-7 branches (usually 5); seta 4-VIII double or triple (Fig. 21) **laticinctus** (p. 67)
- Seta 6-I with at least 3 branches; seta 5-II double; seta 4-VIII single (Fig. 23) (based on a single specimen) **mattinglyi** (p. 72)
- 5(3). Trumpet sharply bent at distal end of tracheoid area; seta 5-IV at least 1.5 length of tergum V (Fig. 7) **vagans** (p. 36)
- Trumpet gently curved; seta 5-IV less than 1.5 length of tergum V 6

*In many specimens, the ventral extension is weak or absent in the middle and the proboscis bears an isolated spot proximal to the ring.

6(5).	Setae 6-III and 3-VII normally double or triple, sum of their branches on both sides of abdomen rarely exceeding 12	7
	Setae 6-III and 3-VII normally with 3-5 branches, sum of their branches on both sides of abdomen rarely 12 or less	10
7(6).	Seta 1-II with at least 25 branches, usually more; trumpet long and slender, index usually more than 6.0 (Fig. 11); occurring in southern part of Arabian Peninsula	decens (p. 44)
	Seta 1-II with fewer than 25 branches, usually fewer than 20; trumpet moderate, index usually less than 6.0	8
8(7).	Seta 5-VI at least 1.5 length of tergum VII; tracheoid area usually more than 0.36 of trumpet length; pinna short, usually less than 0.25 of trumpet length (Fig. 9); occurring in Turkey, (?) Iran and (?) Iraq	torrentium (p. 40)
	Seta 5-VI less than 1.5 length of tergum VII; tracheoid area usually less than 0.36 of trumpet length; pinna longer, normally more than 0.25 of trumpet length; more widespread species	9
9(8).	Trumpet distinctly flared, index less than 5.0; pinna long, about 0.4 or more of trumpet length; seta 8-CT usually triple* (Fig. 5).	quinquefasciatus (p. 31)
	Trumpet widened very little distally, index more than 5.0; pinna shorter, usually less than 0.35 of trumpet length; seta 8-CT with 4-7 branches* (Fig. 3)	pipiens (p. 23)
10(6).	Caudolateral angle of tergum VIII bluntly rounded; trumpet lightly to moderately tanned, length usually more than 0.58 mm; seta 4-CT usually with 3 or 4 branches	11
	Caudolateral angle of tergum VIII produced and acute, if not produced, then trumpet heavily tanned and short, usually less than 0.58 mm, and seta 4-CT normally double	16
11(10).	Seta 1-II dendritic, usually with fewer than 12 branches; trumpet flared, length more than 0.7 mm (Fig. 19)	theileri (p. 61)
	Seta 1-II fanlike, with 12 or more branches (usually more); trumpet almost cylindrical or very little widened distally, length usually less than 0.7 mm	12
12(11).	Seta 5-IV shorter than 1-IV; seta 5-V,VI about as long as following tergum; paddle ovoid, inner part not noticeably narrowed toward base (Figs. 15,17)	univittatus (p. 52) perexiguus (p. 57)

*These characters are unreliable in central and northeastern areas of the Arabian Peninsula where introgressed populations (hybrids) occur.

Seta 5-IV at least as long as 1-IV, usually longer; seta 5-V,VI about 1.5 or more length of following tergum; paddle more or less pear-shaped, inner part distinctly narrowed toward base 13

- 13(12). Abdominal length usually more than 2.6 mm; paddle length usually more than 0.8 mm; pinna of trumpet usually longer than 0.16 mm (Fig. 13). **antennatus** (p. 48)
Smaller species, these measurements usually less than indicated (Figs. 25,27) **simpsoni** (p. 75); **sinaiticus** (p. 78)

sitiens group

- 14(2). Trumpet very strongly flared, funnel-shaped; pinna long, more than 0.36 mm; setae 11-CT, 3-I-III and 1-VII normally single (Fig. 37) **bitaeniorhynchus** (p. 101)
Trumpet not so strongly flared; pinna shorter, less than 0.36 mm; setae 11-CT, 3-I-III and 1-VII usually double 15
- 15(14). Seta 1-II with 1-4 branches; setae 6-III-VI usually single; seta 9-VIII with 4-9 branches (Fig. 35). **mimeticus** (p. 97)
Seta 1-II with 4-10 branches; setae 6-III-VI usually double; seta 9-VIII with 9-14 branches (Fig. 31) **sitiens** (p. 87)
- 16(10). Paddle with conspicuous dark spot on inner part; trumpet length more than 0.75 mm; paddle length more than 0.87 mm; seta 1-VI with 3 or 4 branches (Fig. 33). **poecilipes** (p. 92)
Paddle without dark spot on inner part; trumpet length less than 0.75 mm; paddle length less than 0.87 mm; seta 1-VI with 5-9 branches 17
- 17(16). Seta 1-II with more than 18 branches; seta 8-CT with 6 or 7 branches; caudolateral angle of tergum VII bluntly rounded (Fig. 39) **tritaeniorhynchus** (p. 106)
Seta 1-II with fewer than 18 branches; seta 8-CT with 3-5 branches; caudolateral angle of tergum VIII acute. **pseudovishnui** (p. 111)

LARVAE

1. Siphon strongly swollen, sides markedly convex, with subapical dark band and short spine anteriorly near apex (Fig. 30) . . **duttoni** (p. 82)
Siphon otherwise 2
- 2(1). All scales of comb evenly fringed at sides and apex 3
Some or all scales of comb spinelike, with pointed apex and fringe at sides proximally 13
- 3(2). Distal pecten spines with 2-5 ventral denticles of different sizes arising proximally; seta 1-C thin, scarcely if at all thicker than

branches of setae 5,6-C 4

Distal pecten spines with 7 or more ventral denticles of similar size arising along entire length; seta 1-C stouter, distinctly thicker than branches of setae 5,6-C 16

pipiens group

4(3). Siphon very long and slender, index more than 8.5; seta 1-IV,V long and single, much longer than length of 2 abdominal segments (Fig. 12) **decens** (p. 44)

Siphon not as long and slender, index less than 8.5; seta 1-IV,V shorter, less than length of 2 abdominal segments, with one or more branches, usually more. 5

5(4). Siphon with 6-8 pairs of seta 1-S, with one pair arising laterally and 5-7 irregular pairs arising relatively close to posterior midline; with 2 pairs arising within pecten (Figs. 22, 24). 6

Siphon with 3-6 pairs of seta 1-S, with 1-3 pairs arising laterally and 2-4 pairs arising posterolaterally; sometimes with one pair arising within pecten. 7

6(5). Seta 2-X with 4 or 5 branches; seta 6-VI single; ventral brush with 13 or 14 setae, usually 14 (Fig. 22). **laticinctus** (p. 67)

Seta 2-X only double or triple; seta 6-VI double; ventral brush with 11-13 setae, usually 12 (Fig. 24). **mattinglyi** (p. 72)

7(5). Seta 1-S no longer than diameter of siphon at point of attachment, usually in 5 pairs; seta 6-VI normally single; seta 5-C usually double or triple (occasionally with 4 branches) 8

Seta 1-S longer than diameter of siphon at point of attachment, usually in 4 pairs; seta 6-VI normally double; seta 5-C with 4-8 branches 10

8(7). Seta 1-C long and slender, length about 0.1 mm; siphon with 3 lateral pairs of seta 1-S; seta 1-M usually double or triple, sometimes single (Fig. 14) **antennatus** (p. 48)

Seta 1-C not as long, slightly stouter; siphon with 2 lateral pairs of seta 1-S; seta 1-M usually single, sometimes double. 9

9(8). Seta 1-S distinctly shorter than diameter of siphon at point of attachment (Fig. 16); occurring in southern part of Arabian Peninsula **univittatus** (p. 52)

Seta 1-S about as long as diameter of siphon at point of attachment (Fig. 18); occurring throughout southwestern Asia and Egypt **perexiguus** (p. 57)

10(7). Seta 1-III-V with 3-6 branches (usually 4 or 5), sum of their branches on one side of abdomen 10 or more (usually

- more); seta 1-M normally double or triple; seta 1-X usually double (Fig. 10) **torrentium** (p. 40)
- Seta 1-III-V with 1-4 branches (usually 1 or 2), sum of their branches on one side of abdomen not exceeding 10 (usually 6 or less); seta 1-M normally single; seta 1-X usually single 11
- 11(10). Seta 1-C pigmented, usually spiculate in middle; integument of thorax and abdomen with rows of minute vesicles; seta 13-T as long as 12-T (Fig. 8); occurring in Pakistan, and perhaps Afghanistan and Iran **vagans** (p. 36)
- Seta 1-C not pigmented, sides smooth; integument of thorax and abdomen without vesicles; seta 13-T distinctly shorter than 12-T; more widespread species 12
- 12(11). Siphonal saddle index less than 3.45; seta 1-III,IV usually single* (Fig. 6). **quinquefasciatus** (p. 31)
- Siphonal saddle index greater than 3.45; seta 1-III,IV usually double* (Fig. 4) **pipiens** (p. 23)
- 13(2). Seta 7-I distinctly shorter than 6-I, usually double; seta 14-C with 2 or more branches, rarely single; seta 1-C slender, usually not thicker than branches of setae 5,6-C 14
- Seta 7-I about as long as 6-I, usually single; seta 14-C single; seta 1-C stout, usually much thicker than branches of setae 5,6-C 17
- 14(13). Seta 5-C with 3 or 4 branches; siphon with most elements of seta 1-S arising relatively close to posterior midline, these with 4-11 branches; seta 14-P single (Fig. 20) **theileri** (p. 61)
- Seta 5-C with 1 or 2 branches (usually single); siphon with all elements of seta 1-S arising laterally and posterolaterally, these with 1-4 branches; seta 14-P double on at least one side 15
- 15(14). Pecten borne on proximal third or less of siphon; all scales of comb spinelike (Fig. 26); siphon index usually less than 6.0; occurring in southern part of Arabian Peninsula . . **simpsoni** (p. 75)
- Pecten longer, extending about 0.4 of siphon length; some anterior scales of comb evenly fringed at sides and apex (Fig. 28); siphon index usually greater than 6.0; more widespread species **sinaiticus** (p. 78)

*These characters are unreliable in central and northeastern areas of the Arabian Peninsula where introgressed populations (hybrids) occur.

sitiens group

- 16(3). Seta 5-C with 3 or 4 branches; seta 1-S only slightly longer than diameter of siphon at point of attachment; seta 1-X with 2-4 branches (Fig. 40); siphon index greater than 5.5 **tritaeniorhynchus** (p. 106)
Seta 5-C with 6-8 branches; seta 1-S nearly twice as long as diameter of siphon at point of attachment; seta 1-X single (Fig. 32); siphon index less than 5.5 **sitiens** (p. 87)
- 17(13). Comb with more than 25 scales; seta 2-S long and curved; most elements of ventral brush with 4 branches (Fig. 36). **mimeticus** (p. 97)
Comb with no more than 10 scales; seta 2-S long or short, always straight; most elements of ventral brush with more than 4 branches 18
- 18(17). Median labral plate indistinguishably fused with dorsal apotome; dorsomentum a straight-sided triangle with minutely serrated margins; pecten very short, less than 0.1 length of siphon (Fig. 38) **bitaeniorhynchus** (p. 101)
Median labral plate distinct, separated from dorsal apotome by well-developed suture; dorsomentum an imperfect triangle with large teeth; pecten much longer, about 0.3 length of siphon 19
- 19(18). Anterior margin of siphon distinctly curved in lateral view; length of seta 1-S 2.5-3.0 diameter of siphon; pecten spines with 4-9 basal denticles; setae 2,3-A inserted at apex of antenna (Fig. 34). **poicilipes** (p. 92)
Anterior margin of siphon more or less straight; length of seta 1-S not more than 1.5 diameter of siphon; pecten spines with complete ventral row of denticles; setae 2,3-A inserted subapically (Fig. 42). **pseudovishnui** (p. 111)

THE SPECIES TREATMENTS

Culex (Culex) pipiens Linnaeus

pipiens Linnaeus, 1758: 602. +Neotype male: Silvåkra farm, Veberöd, Scania, Sweden; designated by Harbach et al., 1985: 9 (NMNH).

molestus Forskål, 1775: 85. +Neotype male: Rosetta, Buhayrah Gov., Egypt; designated by Harbach et al. 1984: 523 (NMNH). Synonymy with *pipiens* by Harbach et al., 1984: 540.

bicolor Meigen, 1818: 7. +Type female: ? Africa (MNHP). Synonymy with *pipiens* by Edwards, 1921: 345.

pallipes Macquart, 1838a: 37. Type specimen(s) (non-extant): Egypt. Synonymy with *pipiens* by Edwards, 1932a: 210.

melanorhinus Giles, 1900: 342. *Nomen novum* for *pallipes* Macquart, 1838b, *non* Waltl, 1835: 110.

longefurcatus Becker, 1903: 68. Type female: Cairo, Egypt (ZM). Synonymy with *pipiens* by Edwards, 1932a: 209.

For complete synonymy, see Appendix B.

Culex fatigans Wiedemann of Theobald, 1904: 76 (in part; Egypt); Theobald, 1905b: 92 (Egypt); Gough, 1914: 135 (Egypt).

Culex molestus Forskål of Marshall and Staley, 1937: 17-26 (Egypt, M, F, L, beh., physiol.); Büttiker, 1981: 473 (in part; Saudi Arabia, bionomics).

Culex (Culex) fatigans Wiedemann of Abdel-Malek, 1960: 113-115, 118 (Syria, L bionomics).

Culex (Culex) laticinctus Edwards of Séguy, 1924: 37 (in part; L* in Figs. 20-23, Pl. II, only).

Culex (Culex) molestus Forskål of Parr, 1943: 246-251 (Syria, Lebanon, A, P, L keys, bionomics); Knight, 1951: 354 (Mediterranean Subregion, M, F, L, E, beh., physiol, distr.); Senevet and Andarelli, 1954: 49 (North Africa, M, F, A key); Senevet and Andarelli, 1959: 185 (North Africa, A, M gen., P, L, keys, biol.); Abdel-Malek, 1960: 113-121 (Syria, bionomics, distr.); Lotfi, 1970: 401 [author listed as "(Wiedemann)"] (Iran); Lotfi, 1973: 206 (Iran); Harbach et al., 1984: 523 (Egypt, M*, F*, P*, L*, biol., beh./physiol.).

Culex pipiens Linnaeus of Theobald, 1901b: 132 (World, M*, F, syn., bionomics, distr.); Theobald, 1904: 76 (Egypt); Patton, 1905: 635 (P.D.R. Yemen, L habitat); Theobald, 1905a: 28 (Egypt, syn.); Theobald, 1905b: 93 (Egypt, Israel, Jordan); Edwards, 1913a: 49 (Israel, A); Edwards, 1913b: 53 (Africa, Syn., A, M gen.*); Gough, 1914: 135 (Egypt); Storey, 1918(1919): 87-99 (Egypt, A, L keys, A, bionomics); Barraud, 1920: 324 (Iraq); Barraud, 1921: 393 (Egypt, Israel, Jordan, A, L, distr.); Edwards, 1922: 324 (Oriental Region, A key); Buxton, 1923: 317 (Israel, Jordan, bionomics); Theodor, 1923: 341 (Israel, Jordan, P*, key); Kirkpatrick, 1924 (1925): 368, 371 (Egypt, A, L keys); Salem, 1938: 27 (Egypt); Lewis, 1945: 17 (Sudan, M, F, L, distr.); Knight and Abdel Malek, 1951: 178 (Egypt, M, F, E, L, beh., physiol., bionomics); Dow, 1953: 688 (Iran, L assoc.); Gad, 1956: 135 (Egypt, bionomic note); Gad and Darwish, 1957: 538 (Sinai); Senevet et al., 1957a: 86 (N. Africa, L*); Hussain, 1963: 64 (Iraq); Gad and Salit, 1972: 581 (Egypt, bionomics); Margalit et al., 1973: 32 (Israel); Doyle et al., 1980:

- 676 (Egypt, crossings); El-Said and Kenawy, 1983a (Egypt); Zimmerman et al., 1985: 84 (Egypt, bionomics).
- Culex pipiens molestus* Forskål of Lewis, 1945: 17 (Sudan, M, F, L, bionomics); Theodor, 1952: 113 (Middle East, zoogeogr.); Margalit and Tahori, 1970a: 142 (Israel, bionomics); Margalit et al., 1971: 323 (Israel, bionomics); Margalit and Tahori, 1973: 90 (Sinai, L assoc.); Zaini et al., 1983: 117 (Iraq).
- Culex pipiens pipiens* Linnaeus of Zaini et al., 1983: 117 (Iraq).
- Culex (Culex) pipiens* Linnaeus of Edwards, 1921: 345 (Palearctic Region, A, L keys, tax., syn., distr.); Séguy, 1924: 35 (Palearctic Region, A, L keys, M*, L*, tax., distr., med. imp., syn., distr.); Kirkpatrick, 1925: 133 (Egypt, A, P, L keys, syn., M*, F, P*, L*, bionomics); Edwards, 1926: 142 (Palearctic Region, A, L keys, syn., A, L, distr.); Stackelberg, 1927: 166 (Palearctic Region, M, F keys, A, M gen.*, distr.); Martini, 1931: 374 (Palearctic Region, A, L keys, syn., M*, F, L*, distr.); Edwards, 1941: 314, 420, 482 (Afrotropical Region, A key, M*, F*, P, distr.); Senevet, 1947a: 119 (N. Africa, L*, distr., L assoc., L key); Knight, 1951: 359 (Mediterranean Subregion, M, F, L, E, beh., physiol., distr.); Knight, 1953a: 230 (Yemen Arab Republic, M, L, coll. rec., bionomics); Senevet and Andarelli, 1954: 48 (N. Africa, M, F, A key); Khattat, 1955: 166, 183 (Iraq, L*, distr., syn., bionomics); Lewis, 1956: 710 (Egypt, Sudan, Eritrea, L, coll. rec., bionomics); Abdel-Malek, 1956: 102 (Sinai, bionomics, L key); Mattingly and Knight, 1956: 102 (Saudi Arabia, P.D.R. Yemen, United Arab Emirates, Yemen Arab Republic, A, L* keys, distr., bionomics); Senevet et al., 1957b: 92 (N. Africa, L); Parrish, 1959: 266 (Turkey); Senevet and Andarelli, 1959: 167 (North Africa, A, L, P keys, M*, F, P*, L*); Abdel-Malek, 1960: 121 (Syria, bionomics, distr.); Khalaf, 1962: 46 (Iraq, A, M*, P*, L, bionomics); Derwesh, 1965: 44 (Iraq); DuBose and Curtin, 1965: 352 (Mediterranean area, A, L keys); Abul-hab, 1968: 246 (Iraq, L key); Lotfi, 1970: 401 (Iran); Lotfi, 1973: 206 (Iran); Margalit and Tahori, 1974: 87 (Israel); El-Said and Kenawy, 1983b (Egypt, distr.); Danilov, 1985a: 71 (Afghanistan, A key); Danilov, 1985b: 55 (Afghanistan, L key); Harbach et al., 1985: 9 (Sweden, M*, F*, P*, L*, tax.); Harbach, 1985a: 86, 95, 105 (SW Asia [excluding Pakistan], Egypt, distr., A, L keys).
- Culex (Culex) pipiens* var. *molestus* Forskål of Mattingly and Knight, 1956: 103 (Saudi Arabia, A, L keys, zoogeogr.).
- Culex (Culex) pipiens molestus* Forskål of Monchadskii, 1951: 274 (Middle East, L key, L*, biol.); Hopkins, 1952: 302 (Afrotropical Region, L key, L*, bionomics); Khalaf, 1962: 49 (Iraq, M, F, L, biol.); Margalit and Tahori, 1970b: 152 (Israel); Lotfi, 1976: 84 (Iran, L key, L*); Ibrahim et al., 1983: 92 (Iraq, L* key).
- Culex (Culex) pipiens pipiens* Linnaeus of Monchadskii, 1951: 272 (Middle East, L*, key, biol.); Hopkins, 1952: 300 (Afrotropical Region, L key, L*, bionomics); Senevet and Andarelli, 1959: 184 (North Africa, A, M gen.*, P, L, biol.); Khalaf, 1962: 48 (Iraq, M, F, L, biol.); Lotfi, 1976: 83 (Iran, L key, L*); Ibrahim et al., 1983: 92 (Iraq, L* key).
- Culex quinquefasciatus* Say of Dow, 1953: 688 (in part; northern localities in Iran, L bionomics).
- Culex (Culex) quinquefasciatus* Say of Parrish, 1959: 266 (Turkey).

Adult. A medium-sized mosquito without striking features and special ornamentation. This species closely resembles *quinquefasciatus* with which it has introgressed in certain areas of the Arabian Peninsula. It can be distinguished from *quinquefasciatus* by the following combination of characters: (1) scutal scales golden

brown with reddish tint, (2) integument and scales between supraalar and posterior dorsocentral setae noticeably darker, forming a pair of more or less conspicuous spots, (3) cell R2 at least 4.0 length of vein R2+3, subcosta intersecting costa just beyond furcation of R2+3; (4) basal bands of abdominal terga yellowish, usually same color as sterna, contrasted with white basolateral spots in females.

FEMALE. Dark scaling with metallic blue reflections, reflections lost in aged specimens. *Head:* Length of antennal flagellum about 2.0 mm, entirely dark, flagellomere 1 yellowish to brownish on proximal 0.5, with some tiny, inconspicuous pale scales mesally; pedicel yellowish to brownish, darker mesal surface with or without some tiny pale scales. Proboscis length 1.9-2.3 mm, mean 2.1 mm; dorsal surface dark, darker distally; ventral surface with cream-colored scales on proximal 0.7, distal 0.3 dark; labella yellowish. Maxillary palpus entirely dark-scaled; length 0.4 mm, about 0.2 proboscis length. Forked scales of vertex rather short, dark, some pale medially; falcate scales narrow, pale yellow, paler laterally; lateral spatulate scales creamy white. Ocular setae dark, reddish brown to black, antrorsely curved. Interocular space narrow, with pale falcate scales continuous with those of vertex, and 2 large yellowish-brown setae projecting ventrally over clypeus. *Thorax:* Pleural integument yellowish brown to reddish, faded posteriorly; scutal integument dark brown. Scutal scales fine, golden brown with reddish tint; finer on fossae and supraalar areas; integument and scales between supraalar and posterior dorsocentral setae usually noticeably darker, evident as a pair of ovoid spots, particularly when viewed in dorsal aspect, acrostichal and fossal scales often as dark as ovoid spots; whitish to pale yellow scales on anterior promotory and outer margins of supraalar and prescutellar areas. Scutal setae dark reddish brown to nearly black. Scutellum with whitish to pale yellow falcate scales; 3-6 large setae on each lateral lobe, 7 or 8 on median lobe. Antepronotum with upper and lower patches of whitish to pale yellow falcate scales, scales of lower patch coarser and paler; setae mainly dark, pale ventrally. Postpronotum with golden-brown falcate scales, usually paler and slightly coarser posteriorly; usually with 6 setae (5-9) on posterodorsal margin, longer posteriorly. Pleural setae golden to golden brown: 7-15 upper proepisternal in more or less single row, 5-12 prealar, 3-7 upper mesokatepisternal, 5-13 lower mesokatepisternal, 4-12 upper mesepimeral, and 1 (rarely 2) lower mesepimeral. Pleural spatulate scales nearly white: few below upper proepisternal setae, patches on upper corner and lower posterior border of mesokatepisternum, anterior patch on mesepimeron at level of upper mesokatepisternal patch, and small patch before upper mesepimeral setae. *Wing:* Length 3.6-4.5 mm, mean 4.0 mm; length of cell R2/length of vein R2+3 4.6-6.0, mean 5.3; subcosta intersects costa at or just beyond furcation of vein R2+3; length of cell M1/length of cell R2 0.7-0.8; scales entirely dark. Dorsal scaling: broad squame scales on costa, subcosta, R, R1, and CuA; relatively narrow squame scales on R4+5, M1, M2, M3+4, mcu, and proximally on 1A; linear plume scales on Rs, R2+3, R2, R3, M, M1+2, and distally on 1A; remigium with 2 distinct rows of scales and usually 2, sometimes 3, setae distally. Ventral scaling: squame scales on costa, subcosta, base of R1, Rs, R2+3, bases of R2 and R3, M1+2, and bases of M1 and M2; plume scales on other veins and parts of veins except CuA before mcu and proximal 0.5 of 1A which are without scales. *Halter:* Yellowish, capitellum usually darker with pale scales. *Legs:* Anterior surface of forecoxa mainly black-scaled, with small basal patch of yellowish scales, anterior surface also with many long golden-brown to nearly black ventrally curved setae, apex with 3 or 4 shorter setae on posterior margin, most proximal seta projecting nearly perpendicular to surface, others project ventrally; midcoxa with midlateral longitudinal row of 4 or 5 long golden to golden-brown setae, setae margined anteriorly by longitudinal patch of white spatulate scales, anterior surface with small patch

of black scales and several ventrally projecting setae at apex; posterolateral surface of hindcoxa with longitudinal row of 5-11 golden to golden-brown setae becoming gradually shorter from base to apex, anterolateral surface with narrow longitudinal row of whitish spatulate scales and about 4 short ventrally projecting setae at apex, mesal surface with 2 dark setae at apex. Ventral surfaces of trochanters with white spatulate scales; anteroventral surface of fore- and midtrochanters usually with some black spatulate scales. Apices of all femora with narrow dorsal knee spot of yellowish scales; anterior surface of forefemur black-scaled, posterior surface white-scaled; midfemur like forefemur but black scales extend over dorsal surface toward apex; hindfemur mainly white-scaled, with complete anterodorsal stripe of black scales gradually widening to extend over entire anterior and posterior surfaces just before apex. Foretibia mainly black-scaled, posteroventral surface with whitish scales; midtibia mainly black-scaled, posteroventral surface with whitish scales, anterior and dorsal surfaces with whitish spot at apex. Tarsi black-scaled, slightly paler ventrally, particularly tarsomere 1. Pulvilli pale. Ungues small, simple, black. *Abdomen*: Terga mainly black-scaled; tergum I golden setose, with posteromesal patch of black scales; posterior margins of terga II-VII with row of golden setae, median setae about length of basal band of next tergum, lateral setae longer, about 0.75 of tergum length; tergum II with basomedian spot of yellowish scales (often nearly or entirely lost) and lateral patches of white scales; terga III-VII with basal bands of yellowish scales and basolateral spots of white scales, spots becoming gradually larger on succeeding posterior terga and actually cover entire lateral surfaces of tergum VII, bands 0.15-0.35 tergum length, bands usually convex on terga III-V and separated from or just touching basolateral spots, bands normally straight or slightly concave on terga VI and VII and contiguous with basolateral spots, bands of terga III and VII sometimes nearly or entirely lost; tergum VIII golden setose, usually with whitish scales, sometimes with yellowish scales, scales normally paler than those of basal bands of preceeding terga, sometimes with some dark scales posteriorly in middle. Sterna II-VII mainly or entirely yellowish-scaled (scales same color as basal bands of terga), often with some median black scales, particularly in less arid areas; sternum VIII with whitish scales on lateral margins, broad median area without scales; all sterna golden setose.

MALE. Like female except as follows. Metallic reflections of dark scaling subdued or scales without reflections, sometimes more opalescent than metallic. *Head*: Length of antennal flagellum 1.4-1.6 mm; flagellomeres 1-12 pale between whorls; flagellomeres 13 and 14 0.6-0.7 mm, approximately 0.4 flagellum length. Proboscis without ventral cluster of setae near false joint; false joint about 0.6 from base; ventral pale scales at level of false joint, usually extending 0.5-0.7 from base, sometimes covering most of ventral surface. Length of maxillary palpus 2.2-3.0 mm, mean 2.6 mm, approximately 1.3 proboscis length, extending beyond tip of proboscis by about length of palpomere 5; palpus mainly dark-scaled, integument between palpomeres 2 and 3 pale; lateral surface of palpomere 3 with stripe of cream-colored to white scales in middle, stripe bordered ventrally by row of long black setae on distal 0.5 of palpomere, ventral surface devoid of scales and pale, with ventromesal row of small antrorsely curved pale setae; palpomere 4 with nearly complete ventral stripe of white scales; base of palpomere 5 with small ventral patch of white scales; lateral surfaces of palpomeres 4 and 5 with long black setae that are longest at base of 4 and become gradually shorter toward apex of 5. *Thorax*: Ovoid spots of scutum usually distinct. Proepisternum with 9-25 setae in more or less double row. *Wing*: Length 2.8-3.7 mm, mean 3.3 mm; length of cell R2/length of vein R2+3 2.4-3.6, mean 2.8; subcosta intersects costa at or before furcation of vein R2+3; length of cell M1/length of cell R2 0.70-0.85. *Legs*: Ungues black; anterior foreunguis larger than posterior foreunguis, both stout, anterior foreun-

guis with small ventral tooth near midlength, posterior foreunguis with small tooth nearer base; anterior midunguis like that of foreleg, posterior midunguis shorter and more slender than posterior unguis of foreleg but with tiny ventral tooth near midlength; hindungues very small, simple. *Abdomen*: Terga without basolateral spots; basal bands 0.25-0.40 tergum length, usually straight, or nearly so, and produced posteriorly along lateral scale-free areas, particularly on terga V-VII, giving bands a concave appearance; lateral scale-free areas with long laterally-projecting golden setae. Sterna more frequently with median dark scales; sternum VIII (dorsal in position) entirely pale or with dusky scales posteriorly in middle. *Genitalia* (Fig. 3): Ninth tergal lobes small, each with 7-14 unevenly-spaced setae. Gonocoxite normal, ventrolateral setae strongly developed, these longer and stouter than lateral setae, mesal surface with 5 rows of small setae extending from base to level of subapical lobe; subapical lobe undivided, setae *a-f* in more or less straight row with gap between *c* and *d*, seta *g* immediately lateral to *d-f*, seta *h* lateral to *g*; *a-c* slightly curved, *a* stout and rodlike with blunt apex, *b* and *c* each with stout base, tapering distally and with apex hooked and pointed; *d-f* shorter than *a-c*, hooked apically, *d* and *e* slender, *f* laterally flattened and appearing broad in lateral view; *g* foliform, longer than broad, slightly asymmetrical, apex not sharply produced; *h* slender, bent distally. Gonostylus stout, curved, dorsal surface concave with 2 small slender setae on distal 0.3; gonostylar claw short, broadest apically, troughlike. Phallosome longer than broad with lateral plates and aedeagus of nearly equal length; lateral plate with definite dorsal, lateral and ventral arms, dorsal arm broad, apex nearly truncate, diverging laterally from its mate of the opposite side, appearing slightly sinuous in lateral view; lateral arm broad in lateral view, its posterior margin more or less trilobed, the ventral lobe more prominent than the others and bent ventrolaterally, base of lateral arm with thumblike basal articulatory process (articulates with basal piece), base of this process continuous mesally with dorsal aedeagal bridge; ventral arm narrow and sharply curved with apex directed laterally; DV/D minus 0.14 to zero, mean minus 0.09. Aedeagus subcylindrical, narrowed distally; ventral aedeagal bridge relatively wide, joining aedeagal sclerites just beyond midlength. Proctiger without distinctive features; paraproct with small, conical basal lateral arm, crown dark with numerous short, spinelike spicules. Cercal sclerite elongate, irregularly shaped; 3-6 cercal setae. Tergum X rectangular, adjoining paraproct below and behind basal lateral arm.

Pupa (Fig. 3). Placement and attributes of setae as figured, range and modal number of branches in Table 1; diagnostic characters as in the key. *Cephalothorax*: Lightly tanned, legs, scutum, metanotum and metathoracic wings darker. Setae 1,2-CT with 3-5 branches, most often with 4; 3,4-CT usually triple (2-5); 5-CT usually with 5 branches (3-7); 6-CT usually triple (1-5); 7,9,11-CT double; 8-CT most often with 4 branches (4-7); 10-CT frequently with 8 branches (5-13); 12-CT usually triple (2-5). *Trumpet*: Moderately tanned, subcylindrical, gradually widened distally; index 4.9-6.8, mean 5.4; tracheoid area darker, extending about 0.33 from base; pinna oblique, about length of tracheoid area. *Abdomen*: Lightly tanned, terga I-VI darker in middle; length 2.3-3.7 mm, mean 3.1 mm. Seta 6-I,II normally single; 7-I,II usually double; 1-II multiple (10-24); 1-III-V frequently with at least 6 branches, 1-III,IV most often with 7 branches (5-10), 1-V most often with 6 branches (4-8); 2-II,VII lateral to seta 1, 1-III-VI mesal to 1; 5-IV often with 4 branches, rarely double (2-6); 5-V-VII almost always double; 6-III,IV most often triple, 6-V,VI most often with 4 branches. *Genital lobe*: Lightly tanned; length about 0.20 mm in female, 0.34-0.39 mm in male. *Paddle*: Lightly tanned, midrib and buttress darker; outer margin without distinct spicules; midrib distinct except at apex; length 0.80-1.30 mm, mean 0.93 mm, width 0.62-0.78 mm, mean 0.69 mm, index

1.2-1.6, mean 1.4.

Larva (Fig. 4). Character and positions of setae as figured, range and modal number of branches in Table 21; diagnostic characters as in the key. *Head*: Wider than long; length 0.70-1.04 mm, mean 0.87 mm; width 1.00-1.39 mm, mean 1.25 mm; mainly lightly tanned, labiogula and posterior portions of lateralia and dorsal apotome moderately tanned, dorsal apotome often with variably developed, moderately tanned spots as follows: crescentic spot just anterior to each seta 8-C, small median spot immediately posterior to bases of seta 5-C, median transverse oval spot midway between bases of seta 5-C and posterior margin of head, latter with small spot on either side laterally. Median labral plate narrow but distinct, anterior margin slightly emarginate between insertions of seta 1-C. Labiogula narrower anteriorly than posteriorly, length about same as posterior width; hypostomal suture complete, extended posterolaterally from posterior tentorial pit to near collar. Collar moderately developed along lateralia, heavily tanned. Dorsomentum most often with 10 teeth (8-14) on either side of median tooth. Seta 1-C slender, tapered distally, slightly bent mesad, not tanned; 2-C normally absent; 3-C distinct; 4-C single, rather long; 5-C frequently with 5 branches (4-7); 6-C most often with 4 branches (3-6); 7-C resembles 5,6-C, most often with 10 branches (8-13); 8-C usually double (2-4); 9-C most often with 5 branches (3-7); 10-C usually double (2,3); 11,12,13-C double or triple, 13-C infrequently with 4 branches; 14-C normally single, rarely double. *Antenna*: Length 0.38-0.55 mm, mean 0.45 mm, about 0.5 length of head; moderately tanned, mesal surface with dark spot at base; seta 1-A 0.7 from base; part proximal to seta 1-A with strongly developed aciculae mainly on dorsal and lateral surfaces, distal part slender and smooth except for few short aciculae laterally near seta 1-A. Seta 1-A with about 22 branches (11-27). *Thorax*: Integument hyaline, tubercles of all large setae moderately tanned; setae 1-3-P and 9-12-P,M,T on common tubercles. Setae 1-3-P single, nearly of equal length; 4,7,8-P normally double, occasionally triple; 11-P most often with 5 branches (3-8). Seta 1-M single, about 0.5 length of 3-M; 3-M single; 4-M usually double, occasionally single. Seta 1-T short, 0.5 or less length of 2-T, frequently triple (2-5); 2-T usually single or double, infrequently triple. *Abdomen*: Integument hyaline, tubercles of setae 7-I, 6-I-VI and 1,3-VIII moderately tanned, tubercle of setae 2,3-X heavily tanned. Seta 3-I,VII usually single, occasionally double; seta 6-I-VI long, 6-I,II most often triple, sometimes with 4 branches, 6-II rarely double, 6-III-VI double, 6-III rarely triple; 7-I resembles 6-I, almost always double (1-3); 1-III-VI usually double, one branch longer than the other. *Segment VIII*: Comb with 33-58 scales, mean 45; scales short, evenly fringed on sides and apex, arranged in 4 irregular rows. Seta 1-VIII most often with 5 branches (4-9); 3-VIII frequently with 8 branches (6-9); 5-VIII commonly with 4 branches (3-5). *Siphon*: Index 3.00-5.80, mean 4.58; subcylindrical, broadest at base, slightly sigmoid in lateral view; moderately tanned, darker at base; acus attached, longer on posterior side of attachment. Pecten on basal 0.3 of siphon, with 10-18 spines, mode 14; spines increasing in size from base of siphon, larger spines with 3 or 4 long basal denticles. Seta 1-S usually in 4 pairs (a fifth seta sometimes occurs on one or both sides of siphon), 1a-S very near most distal pecten spine, 1c-S distinctly out of line with the others. *Segment X*: Saddle complete; moderately tanned, darker dorsally; posterodorsal area with minute spicules; length 0.31-0.45 mm, mean 0.36 mm, siphon/saddle index 3.48-4.63, mean 4.08. Seta 1-X usually single (1-3); 2-X usually double, infrequently triple; 4-X almost always in 6 pairs, all setae borne on grid, setae increasing in length posteriad, most posterior seta about 7.5 of most anterior. Anal papillae elongate, subacutely tapered, length variable.

Systematics. *Culex pipiens* is a highly plastic species which is widely distributed in the Holarctic Region and cooler parts of Africa. It occurs throughout Egypt and

generally north of a line transecting Saudi Arabia between Jeddah in the west and Al Hasa Oasis in the east. It occurs north of about 30° N. in countries east of the Persian Gulf. Some isolated populations occur in the southwestern mountains of the Arabian Peninsula.

This species exhibits considerable variation in all stages and it cannot always be distinguished from *quinquefasciatus* and *torrentium* with certainty. In the adult stage, *pipiens* is reliably differentiated from these species by the character of the male genitalia. The immatures are usually separable by the characters given in the keys. Additional characters for separating the larvae of *pipiens* and *torrentium* are discussed by Harbach et al. (1985). The separation of all stages of *pipiens* and *quinquefasciatus* is complicated by the fact that these species introgress in certain areas of Saudi Arabia and Iraq (see discussion under *quinquefasciatus*).

A relatively small, dark variant of *pipiens* occurs in southwestern Asia and Egypt which might be confused with *antennatus*. This variant consists chiefly of females in which the basal pale bands of the abdominal terga are reduced or absent. The occurrence of similar specimens were reported previously by Edwards (1921) and Harbach et al. (1985). Unbanded specimens also occur in Africa (Edwards, 1941). A sporadic larval variant in which the head and siphon are darker than usual is sometimes found in the region. Some dark larvae develop into dark adults (Harbach et al., 1984). A single female from northern Sinai deserves special mention. This specimen (collected by E.E. Austen at El Arish and deposited in the BM) is unusually pale, the wing has a well developed patch of pale scales at the base of the costa, the pale bands of the abdominal terga are white and convex as in *quinquefasciatus*, and the scutal scales are somewhat coarser and paler than usual.

There is tremendous variation in the length of the siphon in the larval stage. Specimens from polluted water tend to have a shorter siphon than specimens from cleaner water, but there is a considerable range in siphon length in almost every collection.

Despite the extensive amount of morphological variation which occurs in all life stages of this species, there is no indication of subspecific or racial differences in the various geographically separated populations examined. The only exception to this might be those populations which occur at higher elevations in the southwestern mountains of the Arabian Peninsula and the mountainous countries of eastern Africa. Insufficient material was available for a critical examination of these populations, but they do not appear to introgress with populations of *quinquefasciatus*, indicating that they may not be as closely related to this species as populations occurring at more northern latitudes. Introgression occurs where populations of *pipiens* and *quinquefasciatus* overlap in the lower Tigris-Euphrates Valley, the coastal plains east of the Persian Gulf, and a narrow zone extending across the Arabian Peninsula from the Gulf of Bahrain to the Red Sea coast in the vicinity of Jeddah. The parental epiphenotypes are distinct outside the zone of introgression, indicating that species-specific traits are being selected outside the zone. This is evidence for independent species cohesion. It supports the taxonomic conclusion that *pipiens* and *quinquefasciatus* are distinct species. The genetic data provided by Urbanelli and Bullini (1985) accords this conclusion. These authors found that allopatric populations exhibit an average Nei's genetic distance of 0.17. Values of similar magnitude have been found among some members of the *Aedes* (*Ochlerotatus*) *caspius* (Pallas, 1771), *Anopheles* (*Cellia*) *gambiae* Giles, 1902, and *Anopheles* (*Anopheles*) *maculipennis* Meigen, 1818 species complexes (Bullini and Coluzzi, 1982).

Bionomics. *Culex pipiens* is the most common species of the subgenus *Culex*

in southwestern Asia. It utilizes numerous and variable breeding places ranging from highly polluted cesspits to clear water pools and containers. The species usually breeds in stagnant water in either shaded or unshaded situations. The water may be fresh or slightly brackish. Populations reach their highest densities in areas occupied by man. It is not uncommon to find larvae in underground habitats such as drains, wells, and septic tanks.

Culex pipiens feeds on a variety of warm-blooded vertebrates from birds to man. Specific host feeding is influenced by host density and availability. In southwestern Asia, the species feeds predominantly on mammals. Females feed at night and readily attack man both indoors and outdoors.

Culex pipiens is an important vector of human pathogens nearly everywhere it occurs. It has been found naturally infected with Sindbis and West Nile viruses in Israel (Samina et al., 1986) and West Nile and Rift Valley Fever viruses in Egypt (Taylor et al., 1953; Taylor et al., 1955; Tahori et al., 1955; Meegan et al., 1980; Meegan, 1981; Turell et al., 1982). The importance of *pipiens* as a primary vector of periodic Bancroftian filariasis in Egypt is well known (see Southgate, 1979 for a thorough review). *Culex pipiens* is a very serious pest in southwestern Asia because of its close association with man.

Distribution. *Culex pipiens* inhabits the temperate regions of Europe, Asia, Africa, Australia, and North and South America.

Material examined. 7,994 specimens. A total of 6,384 specimens (1,386 females, 1,059 males, 205 male genitalia, 1,889 pupal exuviae, 1,129 larval exuviae, and 716 fourth-instar larvae) were examined from southwestern Asia — AFGANISTAN: (Bolla Quichi, Garwargin, He'ral, Kataghan); EGYPT (including the neotype series of *molestus*): *Aswan* (Abu Simbil, Aswan, Dar el Salam, El Aqaba el Saqhira, Ezbet el Silsila, Khour Abu Subeira, Kom Ombo, Nag el Ashbab, Nag el Idwa el Bahari, Nag el Ritag, Nag el Shalabab, Nag Bami' el Gezira, Nag' Tingar, Sahara City), *Buhayrah* (Alexandria, El Tarh, Kafr el Dauwar, Rosetta), *Eastern Deserts* (Farouk Field), *El Fayyum* (Abhit el Haggar, El Nazla, Tubhar), *El Giza* (Abu Rauwash, Barnasht, Dokki, El Badrshein, El Rahawi, Ezbet Bosna Sharawy, Imbaba, Kafr Tohormos, Mena Road, Moneeb, Nazlet el Ashtar, Nazlet el Saman, Saqqara, Talbia, Tanash, Tirsia), *El Isma' iliya* (Abu Khalifa, Isam' iliya, Nifisha), *El Qahira* (Abbassia, Cairo, Ezbet Said), *El Qalyubiya* (Bahtim, El Ga'afara, El Qash-Shish, El Salmaniya, Hashim, Kafr Abo-Seer, Kaha, Khanka, Qalyubiya, Sindiwa), *El Suweis* (Kantara, Suez), *Luxor* (Luxor), *Marsa Matruh* (Siwa Oasis — Abul el Leef, Aghurmi, Ain Bundi, Masouse), *Port Said* (Bur Fu'ad, El Raswa, Port Said), *Red Sea* (Bernece, Ghubbetel Bos, Marsa Alaam, Quseir, Wadi Qiseib, St. Anonious Monastery), *Sinai Peninsula* (Dahab, El Arish, Wadi Feiran), unknown localities; IRAN: (Afzulabad, Alchangi, Amirabad, Ardebil, Behbehan, Bisotun, Bushehr, Cham Asbi, Enzeli, Ghasem Gheshlari, Kamroud, Kermanshah, Khorramshuhr, Khorroniabad, Kivi, Natchi Bahrn, Rasht, Sari, Shemiran, Teheran, Zarjub); IRAQ: (Al Basrah); ISRAEL: (Acre, Beer Sheva, Beit Gubrin, Ben Sheman, Coastal plains, Deir el Belah, Dhahiriya, Ein Gedi, Ein Hajla, Ein Meshoshim, El Athroun, En Aqev, Gennesaret, Golan Nafech, Hadera, Haifa, Jaffa, Jericho, Jerisheh, Jerusalem, Kafr Shammai, Kalia, Kindana, Kishon Marsh, Lake Huleh, Lake Tiberias, Ludd, Nahr Namin, Nazareth, Nulata, Ramat Razi'el, Revivim, Sarona, Shafat, Tell el Nagilla, Tul Keram, Wadi Ghuzze, Wadi Latron, Wadi Shikma, Wassat, Yazur, unknown localities); JORDAN: (Amman, Az Zarqa); LEBANON: (Amioum, unknown localities); P.D.R. YEMEN: (Seiyum); SAUDI ARABIA: (Al Hasa Oasis, Al Hufuf, Al Kharj, Al Qatif, Jeddah); TURKEY: (Istanbul, Izmir, Konya, Sinop, Tatvan); YEMEN ARAB REPUBLIC: (Hada, Hamman 'Ali, San'a, Ta'izz). An additional 1,610 specimens (599 females, 354 males, 45

male genitalia, 344 pupal exuviae, 237 larval exuviae, and 31 fourth-instar larvae) were examined from ALGERIA, ETHIOPIA, KENYA, LIBYA, MAURITANIA, MOROCCO, SOUTH AFRICA, SUDAN, SWEDEN (including the neotype series), TANZANIA, TUNISIA, and ZIMBABWE.

***Culex (Culex) quinquefasciatus* Say**

quinquefasciatus Say, 1823: 10. +Neotype male: New Orleans, Louisiana, USA; designated by Sirivanakarn and White, 1978: 362 (NMNH).

fatigans Wiedemann, 1828: 10. Lectotype female: East Indies [Indonesia]; designated by Belkin, 1968a: 68 (NMW). Synonymy with *quinquefasciatus* by Stone, 1956(1957): 342.

pallidocephala Theobald, 1904: 73. Holotype female: Sennar, Blue Nile, Sudan (BM). Synonymy with *fatigans* by Edwards, 1941: 316.

cartroni Ventrillon, 1905b: 429. +Lectotype male, hereby designated, bearing following data: "6 // MUSEUM PARIS / MADAGASCAR / VENTRILLON 1904 // *Culex* / *cartroni* ventr. / type"; genitalia on acetate strip (MNHP). Synonymy with *fatigans* by Edwards, 1932a: 208.

pygmaeus Neveu-Lemaire, 1906: 256. Syntypes (non-extant): Imi, Ehtiopia. Synonymy with *fatigans* by Edwards, 1932a: 208.

zeltneri Neveu-Lemaire, 1906: 251. Syntypes (non-extant): Harar, Ethiopia. Synonymy with *quinquefasciatus* by White, 1975: 322.

For complete synonymy, see Appendix C.

Culex fatigans Wiedemann of Theobald, 1901b: 151 (World, A key, syn., M*, F*, distr.); Theobald, 1904: 76 (in part; Sudan); Patton, 1905: 635 (P.D.R. Yemen, L habitat); Giles, 1906: 131 (Bahrain); Edwards, 1913b: 55 (Africa, syn., M*, F, distr.); Barraud, 1920: 324 (Iraq); Edwards, 1922: 279 (Oriental Region, A key); Barraud, 1924b: 1264 (India, syn., M*, F, distr.); Barraud, 1924c: 430 (India, L*); Lewis, 1945: 19 (Sudan, M, F, L, distr.); Leeson and Theodor, 1948: 228 (Socotra, L habitat; A, L keys); Hussain, 1963: 64 (Iraq).

Culex (Culex) fatigans Wiedemann of Edwards, 1921: 345 (Iran, Iraq, A, L keys, tax., distr.); Séguy, 1924: 35 (Iran, Iraq, A, L keys, A, M gen.*, tax., distr., med. imp., syn.); Edwards, 1926: 141 (Iran, Iraq, A, L keys, syn., A, distr.); Stackelberg, 1927: 165 (Iran, Iraq, M, F keys, A, M gen.*, distr.); Martini, 1931: 364 (Palaeartic Region, A, L keys, M*, F, L*, distr.); Barraud, 1934: 420 (India, A, L keys, M*, F, L*, syn., L habitat, distr.); Edwards, 1941: 316, 421, 482 (Afrotropical Region, A key, M*, F*, P, syn., distr., bionomics); Lewis, 1943a: 282 (Eritrea, L); Monchadskii, 1951: 261 (Middle East, L*, biol., distr.); Hopkins, 1952: 304 (Afrotropical Region, L*, bionomics); Senevet and Andarelli, 1959: 187 (North Africa, A, P, L keys, A, M gen.*, P*, L*, biol.); Derwesh, 1965: 44 (Iraq); Abul-hab, 1968: 249 (Iraq, L key); Lotfi, 1970: 401 (Iran); Lotfi, 1973: 206 (Iran).

Culex molestus Forskål of Büttiker, 1981: 473 (in part; Saudi Arabia, bionomics).

Culex pipiens fatigans Wiedemann of Zaini et al., 1983: 117 (Iraq, bionomics).

Culex (Culex) pipiens fatigans Wiedemann of Lewis, 1956: 715 (Sudan, Eritrea (?), coll. rec.); Mattingly and Knight, 1956: 103 (Arabian Peninsula, A, L keys, distr., zoogeogr., bionomics); Khalaf, 1962: 50 (Iraq, M*, F, L, A biol., L habitat); Ward,

1972: 96 (Afghanistan); Lotfi, 1976: 84 (Iran, L key, L*); Ibrahim et al., 1983: 92 (Iraq, L* key).

Culex quinquefasciatus Say of Dow, 1953: 688 (in part; southern localities in Iran, L bionomics).

Culex (Culex) quinquefasciatus Say of Knight, 1953a: 230 (Yemen Arab Republic, M gen., L, coll. rec., L habitat); Sirivanakarn, 1976: 30 (Oriental Region, A, P, L keys, M*, F*, P*, L*, tax., distr., bionomics, med. imp.); Danilov, 1985a: 71 (Afghanistan, A key); Danilov, 1985b: 55 (Afghanistan, L key); Harbach, 1985a: 86, 95, 105 (SW Asia, distr., A, L keys).

Adult. A medium-sized species closely resembling *Culex pipiens* with which it has introgressed in northeastern and central areas of the Arabian Peninsula. This species is distinguishable from *pipiens* by the following combination of characters: (1) scutal scales more or less buff-colored, relatively long and sparse, giving scutum a rather shaggy appearance, (2) integument and scales between supraalar and posterior dorsocentral setae usually not markedly shorter or noticeably darker than surrounding scales, (3) length of cell R2 less than 4.0 length of vein R2+3, subcosta intersects costa before furcation of vein R2+3; (4) basal bands of abdominal terga whitish to cream-colored, slightly if at all darker than basolateral white spots, usually slightly paler than sterna.

FEMALE. Dark scaling with metallic blue reflections, reflections lost in aged museum specimens. *Head:* Antennal length 1.6-2.0 mm, mean 1.8 mm; flagellum dark, base of flagellomere 1 and most of pedicel whitish to yellowish orange; mesal surface of pedicel dark with some inconspicuous scales and/or setae. Proboscis length 1.7-2.1 mm, mean 1.9 mm; mainly black-scaled, ventral surface with cream-colored scales on proximal 0.7, pale scaling most pronounced broadly in middle. Maxillary palpus short, less than 0.2 proboscis length, entirely black-scaled. Falcate scales of vertex narrow, whitish to pale yellow, slightly paler along margin of eye; forked scales pale medially, dark laterally; lateral spatulate scales narrow, white; ocular setae golden brown. Interocular space narrow, with some ventrally projecting falcate scales coarser and slightly paler than those of vertex, with 2 long golden to golden-brown setae projecting downward over clypeus. *Thorax:* Integument yellowish brown, scutum slightly darker than pleura. Scutal scales slightly coarser and less dense than in *pipiens*, more or less buff-colored (at low magnification), slightly paler on margins and prescutellar area; integument and scales between supraalar and posterior dorsocentral setae usually not distinctly shorter or darker than surrounding integument and scales. Each lobe of scutellum with falcate scales concolorous with prescutellar scales; lateral lobes each with 5 or 6 large setae and several smaller setae, large setae in 2 rows with 2 setae in dorsal row and 3 or 4 in ventral row; middle lobe with 6 or 7 large setae in single row and several scattered small setae. Antepnotum with whitish to pale yellow falcate scales confined mainly to dorsal and ventral patches, dorsal patch coarser; setae concolorous with scutal setae, paler ventrally. Postpronotum with pale yellow to golden-yellow falcate scales, scales paler and coarser posteriorly; with curved posterodorsal row of 7 or 8 setae, setae more or less same color as scutal setae, posterior 2 or 3 setae paler. Pleural setae pale yellow to golden yellow, numbers follow: usually 6 upper proepisternal, 8-10 prealar, 5 or 6 upper mesokatepisternal, 7-9 lower mesokatepisternal, usually about 7 upper mesepimeral and 1 lower mesepimeral. Proepisternum with small number of elongate white spatulate scales below upper proepisternal setae, usually few dark scales mesal to setae. Mesopleuron with the usual patches of white spatulate scales in upper and lower positions on katepisternum and anterior and upper positions on anepimeron. *Wing:*

Length 3.1-3.8 mm, mean 3.4 mm; length of cell R2 2.8-3.3 length of vein R2+3; subcosta usually intersects costa before furcation of vein R2+3; length of cell M1 0.8 length of cell R2; entirely dark-scaled. Dorsal scaling: broad squame scales on costa and subcosta; narrow spatulate to near fusiform (decumbent) scales on R, R1, R3+4, distally on M1, M2, mcu, M4+5, CuA, and all but distally on 1A; linear plume scales on Rs, R2+3, R2, R3, M, M1+2, proximally on M1, and distally on 1A; remigium with 2 rows of scales and 2 or 3 setae distally. Ventral scaling: broad squame scales on costa, Rs, R2+3, M1, M1+2, and proximally on M1; linear plume scales on R, R1, R2, R3, R4+5, distally on M1, M2, M2+3, mcu, CuA distad of mcu, and about distal 0.3 of 1A; CuA proximal to mcu and about proximal 0.7 of 1A without scales. *Halter*: Pedicel and scabellum pale; capitellum dark with pale scales. *Legs*: Forecoxa with patch of whitish scales at base continuous with predominantly black scales of anterior surface, variable number of whitish scales usually near middle of anterior surface, ventrally curved anterior setae golden brown, usually with 2 more or less prominent laterally projecting and several less conspicuous ventrally projecting setae apically on posterolateral margin; midcoxa with narrow longitudinal patch of white spatulate scales on anterior side of longitudinal row of usually 4 large golden-brown and several smaller paler setae on lateral midline, pale scales continuous with small apical patch of black scales, number of small ventrally projecting pale setae anterolaterally at apex; hindcoxa with somewhat inconspicuous narrow longitudinal patch of whitish scales on anterolateral margin, with 6-8 golden posterolateral setae and about 4 short golden setae at apical end of scale patch. Trochanters with white scales on ventral surface extended onto anterior and posterior surfaces; fore- and midtrochanters often with some black scales anteromesally. Femora with inconspicuous narrow yellowish knee spots; fore- and midfemora black-scaled anteriorly, white-scaled posteriorly, black scaling of midfemur gradually expanded over dorsal and onto posterior surface toward apex; hindfemur white-scaled with anterodorsal stripe of black scales gradually expanded distally over anterior and posterior surfaces, sometimes nearly forming complete subapical ring. Tibiae mainly black-scaled, foretibia with whitish scales ventrally; midtibia with whitish scales posteroventrally; hindtibia like foretibia with somewhat indistinct apical pale spot mainly on dorsal and anterior surfaces. Tarsi dark, slightly paler ventrally; tarsomeres 1-4 with hint of pale scaling dorsally at apex. Pulvilli pale. Ungues small, simple. *Abdomen*: Tergum I golden setose, with median posterior patch of black, white or mixture of black and white scales; terga II-VII with long golden setae on lateral and posterior margins, setae short medially on posterior margin; tergum II with median basal triangular patch of whitish or very pale yellow scales and lateral patches of white scales; terga III-VII with nearly white convex basal bands and white basolateral spots, bands about 0.4 tergum length, spots becoming larger on succeeding posterior terga, bands not touching or narrowly continuous with spots on terga III-V, bands continuous with spots on terga VI and VII, tergum VII with some pale scales on posterior border; tergum VIII entirely pale-scaled. Sterna II-VII nearly white to yellowish, usually more yellow (slightly darker) than basal bands of terga, often with some median black scales which sometimes form rather large patch not reaching posterior border, occasionally with few black scales on posterolateral corners.

MALE. Like female except as follows. *Head*: Proboscis without ventral cluster of setae near false joint; false joint about 0.6 from base; pale scaling mainly in middle ventrally, forming indistinct more or less complete narrow ring at false joint. Length of maxillary palpus about 2.0-2.6 mm, mean 2.4 mm, extending beyond tip of proboscis by length of palpomere 5 (palpus of some males from Djibouti only slightly longer than proboscis or exceed its length by no more than 0.5 length of palpomere 5); integument pale across joint between palpomeres 2 and 3; middle of palpomere 3 with elongate

patch of cream-colored scales on dorsal and lateral surfaces, palpomere with about 14 long ventrolateral setae on distal 0.33 and longitudinal row of short antrorsely curved setae on ventromesal margin; palpomere 4 with complete ventral line of white scales, distal scales usually darker with bluish hue; palpomere 5 with small ventral patch of white scales at base. *Thorax*: Scutal scales slightly longer and narrower, of more uniform size than in female. Propleuron with 2 irregular ventromesally oriented rows of upper proepisternal setae. *Wing*: Length 2.6-3.2 mm, mean 3.0 mm; length of cell R2 1.8-2.2 length of vein R2+3; length of cell M1 0.75-0.85 length of cell R2. *Legs*: Anterior unguis longer than posterior unguis on fore- and midlegs, each with ventral tooth near middle. *Abdomen*: Terga without basolateral spots, basal bands produced posteriorly on lateral margins, particularly on terga VI and VII; tergum VIII (ventral in position) largely or entirely pale-scaled. Sterna more frequently with median black scales than in female; sternum VIII (dorsal in position) variable, often like tergum VII, sometimes largely pale-scaled. *Genitalia* (Fig. 5): Form as figured; essentially as in *pipiens*, differing chiefly in details of the phallosome. Ninth tergal lobe with 4-14 setae (mode 8). Seta *f* of subapical lobe of gonocoxite sometimes duplicated, distinctly hooked. Lateral plate of phallosome conspicuously broader at base; dorsal arm not as broad, apex pointed, nearly parallel with its mate of the opposite side; dorsal and ventral lobes of lateral arm more prominent; ventral arm broad and long; DV/D 0.56-1.89, mean 1.03. Paraproct with short, slender basal lateral arm.

Pupa (Fig. 5). Character and placement of setae as figured, range and modal number of branches in Table 2; very similar to *pipiens*, but usually separable by the character of the trumpet and seta 8-CT. *Cephalothorax*: Seta 5-CT usually with 4 branches (2-4); 6-CT often double (2-4); 8-CT usually triple (2,3). *Trumpet*: Relatively short and flared apically; index 2.9-4.8, mean 4.2; pinna oblique, long, length 0.4 or more of trumpet length. *Abdomen*: Length 3.2-4.0 mm, mean 3.6 mm; seta 1-III-V frequently with 4 or 5 branches, 1-III most often with 5 branches (4-7), 1-IV,V most often with 4 branches (3-6); 5-IV usually double or triple, sometimes with 4 branches; 6-III,IV double or triple, more often double. *Paddle*: Length 0.98-1.16 mm, mean 1.04 mm; width 0.74-0.87 mm, mean 0.82 mm; index 1.1-1.4, mean 1.3.

Larva (Fig. 6). Character and positions of setae as figured, range and modal number of branches in Table 22; closely resembling *pipiens* from which it cannot always be separated, the most reliable diagnostic features from *pipiens* include the siphon/saddle index and character of seta 1-III,IV. *Head*: Length 0.74-0.88 mm, mean 0.83 mm; width 1.13-1.30 mm, mean 1.21 mm. Dorsomentum most often with 12 teeth (10-13) on either side of median tooth. Seta 2-C normally present, very small; 6-C most often with 5 branches (3-5); 7-C most often with 8 branches (7-10); 8-C often triple (2-4); 10-C most often triple (1-3). *Antenna*: Length 0.43-0.50 mm, mean 0.45 mm. *Thorax*: Seta 1-T frequently double (2-5). *Abdomen*: Seta 1-III,IV normally single, seldom double (more seldom double on both segments). *Siphon*: Generally shorter and stouter than in *pipiens*, index 2.88-4.64, mean 3.70. Pecten with 5-17 spines, mode 10. Seta 1-S usually in 4 pairs, occasionally in 3 pairs, seldom with a fifth seta on one side; number of branches variable, tending to have a greater number than in *pipiens*, particularly 1a- and 1b-S (*cf.* in Tables 21 and 22). *Segment X*: Saddle length 0.35-0.48 mm, mean 0.41 mm; siphon/saddle index 2.77-3.41, mean 3.11.

Systematics. *Culex quinquefasciatus* is a variable but fairly well differentiated species which has introgressed with *pipiens* in areas where the two species come together. During this study, 180 mongrels (57 females, 67 males, and 56 male genitalia) were examined from the lower Tigris-Euphrates Valley in Iraq, the eastern coastal region of Saudi Arabia along the Persian Gulf, Al Kharj Oasis near Riyadh, and Jeddah on the

Red Sea coast. Hybrids are morphologically more variable than the parental species. Some hybrids are recognizable in having the scutal scaling of one species and the abdominal banding of the other species, but in general the only reliable means of distinguishing hybrids from the recurrent parental species is by the male genitalia. The form of the dorsal and ventral arms of the phallosome is intermediate between that found in *pipiens* and *quinquefasciatus*. Hybrid males examined from southwestern Asia have DV/V ratios ranging from 0.08 to 0.43 with a mean of 0.18. Mongrels of partial hybrid ancestry may be indistinguishable from the parental species. For this reason, some hybrid specimens collected in and around the zone of introgression were probably misidentified as parental epiphenotypes during the course of this study. There is no doubt, however, that the parental epiphenotypes show independent species cohesion outside the zone. The two epiphenotypes are closely related, distinct species. The capacity for *pipiens* and *quinquefasciatus* to interbreed should not be considered as *prima facie* evidence for incomplete speciation.

Culex quinquefasciatus is widely distributed in the tropical and subtropical zones of the world where it has no doubt been spread by commerce. However, the taxon has not been sufficiently studied throughout its range and it is possible that it consists of two or more biological species. There is currently no evidence to suggest that more than one species occurs in southwestern Asia.

Bionomics. *Culex quinquefasciatus* is a common domestic and peridomestic species which has received considerable attention in the literature. It breeds mainly in polluted water but is also found in clean fresh water and brackish water habitats. The immatures occur in virtually all types of man-made and natural breeding places. Females are undoubtedly anthropophilic but readily feed on a variety of other mammals and birds depending on the availability of hosts. Biting occurs both indoors and outdoors at night, and engorged females can be found resting either inside or outside dwellings and shelters.

Although it is well known that *quinquefasciatus* is an important vector of filarial and viral agents of human disease in many parts of the world, there are no published reports of natural infection in southwestern Asia. *Culex quinquefasciatus* is the predominant vector of urban filariasis in areas of Africa and the Orient. It has been found infected with Japanese encephalitis virus in Vietnam (Nguyen et al., 1974) and Chikungunya virus in Tanzania (White, 1971). It is capable of transmitting West Nile virus in India (Rao, 1975) and Murray Valley encephalitis virus in Australia (Karabatsos, 1985).

Distribution. *Culex quinquefasciatus* is widely distributed in the tropical and subtropical regions of the world.

Material examined. 1,113 specimens. A total of 907 specimens (306 females, 308 males, 256 male genitalia, 10 pupal exuviae, 5 larval exuviae, and 22 fourth-instar larvae) were examined from southwestern Asia — BAHRAIN: (specific localities unknown); IRAN: (Alchangi, Bushehr, Enzeli, Halileh, Hizan, Kish Island, Manyuhi, Nahr Mohsen, Shush); IRAQ: (Amara, Baghdad, Basrah); OMAN: (Muscat, Salalah); PAKISTAN (including localities east of the Indus River): (Jhang, Jhelum, Lahore, Peshawar, Rawalpindi); P.D.R. YEMEN: (Anag, Lahej, Makhzan, N'Air, Wadi Duan); SAUDI ARABIA: (Al Hasa Oasis, Al Khobar, Al Qatif, Al Ta'if, Dhahran, Jeddah, Mecca, Saihat); YEMEN ARAB REPUBLIC: (Murawah). An additional 206 specimens (102 females, 46 males, 31 male genitalia, 12 pupal exuviae, 12 larval exuviae, and 3 fourth-instar larvae) were examined from DJIBOUTI, ETHIOPIA, MAURITANIA, MOZAMBIQUE, NEPAL, SENEGAL, SOCOTRA, SOUTH AFRICA, SUDAN, UGANDA, and the UNITED STATES (the neotype series).

***Culex (Culex) vagans* Wiedemann**

vagans Wiedemann, 1828: 545. Syntypes (non-extant); Foochow (Barraud, 1934: 416), China.

tipuliformis Theobald, 1901b: 325. +Holotype female: Bakloh, N. W. Provinces (? Pakistan) (BM). Synonymy with *vagans* by Edwards, 1926: 136.

virgatipes Edwards, 1914b: 126. +Holotype male: Hong Kong (BM). Synonymy with *vagans* by Edwards, 1926: 136.

exilis Dyar, 1924: 127. +Lectotype male: Vladivostok, [Maritime Territory], USSR; designated by Stone and Knight, 1957: 49 (NMNH). Synonymy with *vagans* by Edwards, 1926: 136.

Culex tipuliformis Theobald of Barraud, 1924b: 1269 (India, A key, syn., M*, F, distr.); Barraud, 1924c: 430 (India, L*).

Culex vagans Wiedemann of Theobald, 1901a: 411 (Oriental Region, A key, F*).

Culex (Culex) vagans Wiedemann of Edwards, 1926: 136 (Palearctic Region, A, L keys, syn., A, distr.); Martini, 1931: 391 (Palearctic Region, A, L keys, M*, F, syn.); Barraud, 1934: 416 (India, A, L keys, syn., A, M gen.*, L*, L habitat, distr.); Monchadskii, 1951: 283 (Middle East, L key, L*, bionomics, distr.); (?) Parrish, 1959: 266 (Turkey); DuBose and Curtin, 1965: 352, 354 (Mediterranean area, A, L keys); (?) Lotfi, 1970: 400, 402 (Iran); Aslamkhan, 1971: 155 (Pakistan); (?) Lotfi, 1976: 73, 76 (Iran, L key, L*); Sirivanakarn, 1976: 37 (Oriental Region, A, P, L keys, M*, F, P*, L*, tax., bionomics, distr.); Harbach, 1985a: 86, 94, 105 (Afghanistan, Iran [not Egypt], Pakistan, A, L keys).

Adult. This medium-sized species resembles *theileri* in having anterior pale stripes on the fore- and midfemora and all tibiae, but is easily distinguished by the absence of postspiracular and prealar scales. The species otherwise resembles *pipiens*, which of course lacks the striped legs. The male genitalia are strikingly similar to those of *torrentium*.

FEMALE. *Head:* Length of antenna about 2.2 mm; pedicel usually mainly yellow, mesal surface black, both pedicel and flagellomere 1 with some small white scales on mesal surface; flagellum normal, whorls normally with 6 setae. Proboscis length 2.0-2.4 mm, mean 2.2 mm; sides and venter with cream-colored scales extending from 0.15 to 0.70 from base, proximal and distal portions distinctly black-scaled. Maxillary palpus dark-scaled with white scales mainly confined to dorsal stripe on palpomeres 3 and 4; length about 0.4 mm, about 0.2 proboscis length. Vertex with whitish to pale yellow falcate scales, usually paler medially and along ocular line; forked scales mainly brown, some pale ones usually in middle; lateral spatulate scales white or nearly so. Interocular space with few pale scales, concolorous with ocular scales. Ocular setae dark brown with golden or reddish sheen; 2 yellowish interocular setae project ventrally over clypeus. *Thorax:* Pleural integument yellowish brown to brown; scutal integument brown. Color of scutal scales ranging from brownish yellow to golden brown, often mainly yellowish brown, surface sometimes appearing somewhat mottled with fossal, sublateral supraalar and occasionally posterior acrostichal scales darker; scales pale yellow, whitish or even white on anterior and lateral margins and on prescutellar area. Scutal setae dark brown with golden or reddish sheen. Scales of scutellum same color as prescutellar scales; lateral lobes each with 4 or 5 large setae, median lobe with 6-8. Anteprepronotum mainly

with dark brown setae, some yellowish ones ventrally; with rather coarse falcate scales in upper and lower patches, upper patch brownish yellow, lower whitish. Postpronotum with brownish-yellow falcate scales, some paler (frequently whitish) posteriorly; with usually 6 or 7 dark setae on posterodorsal margin. Pleural setae golden: 8-12 upper proepisternal, 10-12 prealar, 4-6 upper mesokatepisternal, 9-13 lower mesokatepisternal, 10-14 upper mesepimeral, and 1 lower mesepimeral. Pleura with white, elongate spatulate scales in patches as follows: small patch below upper proepisternal setae, patches on upper corner and lower posterior border of mesokatepisternum, anterior patch on mesepimeron at level of upper mesokatepisternal patch, and patch before and among upper mesepimeral setae; lower mesokatepisternal and upper mesepimeral scales semierect, others decumbent. *Wing*: Length 3.5-5.4 mm, mean 4.5 mm; length cell R2 2.9-3.8 length of vein R2+3, mean 3.3; length cell M1 0.8 length of cell R2; scales predominantly dark, pale scales on subcosta and posterior side of costa on dorsal and ventral surfaces, dorsal surface also with pale scales on anterior and posterior sides of R1 distal to furcation of vein R2+3. *Halter*: Integument usually yellowish, dorsal areas of pedicel and capitellum often dark; scales entirely pale. *Legs* (midleg, Fig. 2G): Anterior surface of forecoxa dark-scaled in middle, with patches of white scales at base and apex; midcoxa with longitudinal patch of white scales on anterior side of midlateral row of strong setae, anterior surface with spot of scales at apex; hindcoxa with longitudinal patch of white scales on anterior side of lateral midline, posterolateral margin with irregular row of strong setae. Lateral surfaces of trochanters without scales, other surfaces white-scaled, anterior surface of foretrochanter often with some dark scales. Femora mainly white-scaled, apices with pale knee spots, spots often indistinct on fore- and midfemora; anterior and dorsal surfaces of fore- and midfemora dark-scaled, anterior surface with narrow longitudinal white stripe, forefemur sometimes with ventral 0.5 of anterior surface completely white-scaled, or nearly so, because anteroventral dark scaling partially or completely absent; hindfemur with complete anterodorsal stripe of dark scales, stripe gradually widening distally, expanded over approximately distal 0.5 of dorsal surface but may or may not be expanded over whole of anterior surface very near apex. Anterior and posterior surfaces with dark scales; dorsal surface with spot of white scales at apex; ventral dark scales of foretibia sometimes partly or entirely replaced by white scales. Tarsi dark-scaled with faint anterior and posterior pale stripes on tarsomere 1. *Abdomen*: Tergum I with median posterior patch of yellowish scales; terga II-VII mainly clothed in dark brown to blackish scales; terga II-VII with rather large basolateral patches of white scales, sometimes covering most or all of lateral surface, particularly on terga II, VI and VII; tergum II with basomedian patch of yellowish scales, patch sometimes lengthened posteriorly; terga III-VII with basal bands of yellowish scales, bands 0.3-0.5 of tergum length, bands of terga III-V (and often VI and sometimes VII) convex, those of VI and VII often straight or nearly so, bands of terga III and IV (and frequently V and VI) not reaching basolateral white patches; tergum VIII usually entirely pale-scaled, sometimes with some dark scales posteriorly. Sterna II-VII mainly clothed in yellowish scales, with a median area of dark scales; sternum VIII with lateral patches of pale scales, median area without scales.

MALE. Like female except for the following principal differences. *Head*: Proboscis with indefinite pale band (narrowly incomplete dorsally) about 0.5-0.7 from base, pale scaling of ventral surface extending from band to about 0.2 from base; false joint 0.6 from base; without ventral cluster of setae at false joint. Maxillary palpus mainly dark-scaled above; lateral surface of palpomere 3 with rather broad stripe of white scales 0.2-0.8 from base, mesal surface with complete or nearly complete narrow line of white scales which is broader and more noticeable near apex, ventrolateral margin with row of

about 28 long dark setae on distal 0.5, ventromesal margin with complete row of short, pale, antorsely curved setae; palpomere 4 with complete ventral stripe of white scales and dorsal spot of rather subtle pale scales at base; dorsal surface of palpomere 5 like that of 4, ventral surface with distinct basal spot of white scales; lateral and mesal surfaces of palpomeres 4 and 5 densely setose; palpus exceeds length of proboscis by length of palpomere 5. *Thorax*: Scutal scales finer. Upper proepisternal setae more numerous. *Wing*: Length of cell R2 1.5-2.0 length of vein R2+3; subcosta intersects costa before furcation of vein R2+3; length of cell M1 0.8-0.9 length of cell R2. *Abdomen*: Terga II-VII without lateral white patches; basal bands of terga III-VII either convex or nearly straight, bands of terga V-VII produced posteriorly along lateral scale-free areas but only slightly so on V; tergum VIII (ventral in position) with pale scales before median posterior setose area. Sterna II-VII usually with median dark scales forming distinct stripe; sternum VIII (dorsal in position) entirely pale-scaled. *Genitalia* (Fig. 7): Form as figured; in general as in *pipiens* and related species. Ninth tergal lobe short and broad, with 6-14 unevenly spaced setae. Gonocoxopodite essentially as in *pipiens*; subapical lobe indistinctly divided, seta *g* on small prominence with *h* at its base laterally; usually 2 setae in group *d-e*, sometimes only 1, sometimes 3; seta *g* not as broad, pointed; *h* flattened and shorter. Phallosome longer than broad with lateral plates slightly longer than aedeagal sclerites; dorsal arm slightly twisted and pointed apically, diverging laterally from its mate of the opposite side but not appearing sinuous in lateral view; lateral arm longer than broad, with prominent triangular laterally directed apical lobe and a short dorsal process, apical lobe minutely spiculate on posterior surface, dorsal process relatively short and borne on dorsal margin between apical lobe and rather weakly developed basal articulatory process; ventral arm short, bent as in *pipiens*. Aedeagus short, somewhat conical; aedeagal sclerites about as long as broad; ventral aedeagal bridge rather narrow, joining aedeagal sclerites near midlength. Proctiger normal; paraproct with long, rather stout, ventrally curved basal lateral arm, crown with numerous spinelike spicules and some short lateral blades. Cercal sclerite elongate, with 2-5 cercal setae. Tergum X developed as usual.

Pupa (Fig. 7). Placement and attributes of setae as figured, range and modal number of branches in Table 3; differing little from *pipiens* and allied species, but usually recognized without much difficulty by the bent trumpet and relatively long seta 5-IV. *Cephalothorax*: Seta 1,2,4,6-CT usually with 3 or 4 branches; 3-CT usually triple (2,3); 7-CT double; 8-CT tending to have more branches than usual (3-9); 9-CT with 2-4 branches; 11-CT usually double, sometimes single. *Trumpet*: Distinctly bent at distal end of tracheoid area; index 5.0-6.9, mean 5.6; pinna short, 0.15-0.20 length of trumpet. *Abdomen*: Length 2.1-2.6 mm, mean 2.4 mm. Seta 1-III-VII tends to have more branches than in *pipiens* and related species, 1-III frequently with 9 or 10 branches (6-11), 1-IV often with 8 branches (5-10); 5-IV as strong as 5-V,VI, normally double or triple (2-4). *Paddle*: Length 0.73-0.81 mm, mean 0.78 mm; width 0.51-0.60 mm, mean 0.56 mm; index 1.2-1.6, mean 1.4.

Larva (Fig. 8). Placement and character of setae as figured, range and modal number of branches in Table 23; very similar to *pipiens*, but usually easily recognized by the character of seta 1-C and the presence of rows of minute vesicles on the thoracic and abdominal integument. *Head*: Length 0.76-0.92 mm, mean 0.82 mm; width 1.17-1.30 mm, mean 1.24 mm; lightly to moderately tanned, darker behind eyes, gula also usually darker; collar and dorsomentum heavily tanned. Dorsomentum usually with 9 teeth (8-11) on either side of median tooth. Seta 1-C long, tapered, tanned, and usually spiculate in middle; seta 2-C absent. *Antenna*: Generally slightly longer than in *pipiens*, length 0.52-0.58 mm, mean 0.57 mm. Seta 1-A with about 25 branches

(20-33). *Thorax*: Integument with rows of minute vesicles. Seta 1-M single, normally slightly longer than 0.5 length of 3-M. Seta 1-T about 0.5 length of 2-T; 2-T frequently single, sometimes double; 13-T rather long, about same length as 12-T. *Abdomen*: Integument with rows of tiny vesicles, changing to rows of tiny spicules on segment VIII. Seta 6-I usually triple (2-4), 6-II usually with 3 or 4 branches (3-5), 6-III-VI almost always double, occasionally triple. *Segment VIII*: Comb with 36-47 scales, mean 41. *Siphon*: Generally longer than in *pipiens*, index 3.92-6.72, mean 5.39; lightly to moderately tanned. Pecten with 10-15 spines, mode 13; larger spines with 2-5 denticles, usually 3 or 4. Seta 1-S usually in 4 pairs, occasionally with a fifth seta on one side; 1b-S often inserted laterally in line with 1c-S. *Segment X*: Saddle length 0.38-0.47 mm, mean 0.41 mm; siphon/saddle index 3.79-4.59, mean 4.19. Seta 1-X single or double, more often single. Anal papillae equal in length, slightly longer than saddle.

Systematics. *Culex vagans* and the next species (*torrentium*) bear a pronounced resemblance to members of the *pipiens* subgroup, but based on the male genitalia they unmistakably belong to the *trifilatus* subgroup of Mattingly and Rageau (1958). *Culex vagans* is the most distinctly marked member of the subgroup, the adults being readily distinguished from all other species of the group, as well as from *pipiens* and *quinquefasciatus*, by the striped femora and tibiae. This species bears a superficial resemblance to *theileri* with which it has been confused in the past.

This species occurs in a relatively broad belt which stretches from the Middle East to Hong Kong, Japan, and Korea. Its exact distribution in southwestern Asia is unknown. I have seen specimens only from Afghanistan and Pakistan, but the species has been reported to occur in Iran (Lotfi, 1970; 1976) and Turkey (Parrish, 1959). I am somewhat skeptical about the records from Iran because they are based on limited collections of larvae. Characters which have been used to separate the larva of *vagans* from the larvae of *pipiens*, *quinquefasciatus*, and *torrentium* are certainly not as reliable as they appear to be in previously published keys (see the list of earlier works following the synonymy). In fact, the characters used in my key are probably not completely reliable because of the very limited number of specimens examined. Concerning the record from Turkey, it is not clear whether Parrish (1959) based his identification on larval or adult specimens. Parrish apparently collected much of his material in light traps. It is possible that his record of *vagans* from Turkey is based on damaged and/or partially or completely denuded females of *theileri* and/or males of *torrentium* collected in light traps. I would have the same concern about the identification of larvae of *vagans* from Turkey that I have for the identification of larvae from Iran. Mattingly (1955a: 31) identified three male genitalia and a larva of *torrentium* from Turkey which were labelled previously as *vagans* by Martini (1931).

The adult and immature specimens examined during this study seem to conform quite well with the recent descriptions of this species based on material from eastern Asia (Sirivanakarn, 1976; Tanaka et al., 1979). The only obvious difference is the development of seta 1-C in the larva, and this may be within the normal range of geographic variation. At present there seems to be no reason to suspect that more than one species exists under the name of *vagans*, but this will not be known for certain until considerably more material from southwestern and central Asia is studied in detail.

Bionomics. Little specific information is available on the bionomics of *vagans*. In eastern Asia, the immature stages are found in permanent or semipermanent bodies of fresh ground water, including streams, stream pools, ponds, lakes, and marshes. Larvae have been collected in Iran in ponds with or without vegetation (Lotfi, 1976). In Japan and Korea, females are known to bite man at night (Hsiao and Bohart, 1946; Barnett and Toshioka, 1951). *Culex vagans* has been reported to be naturally and

experimentally infected with larvae of *Wuchereria bancrofti* (Yamada, 1927, as *tipuliformis* Theobald; Manson-Bahr, 1959; Hsiao, 1948; Hsiao and Bohart, 1946) and should be regarded as a potential vector of this pathogen in southwestern Asia.

Distribution. This species is widespread in eastern and southcentral areas of the Palaearctic Region. It is known to occur in eastern Siberia, Korea, Japan, Hong Kong, China, Mongolia, Bangladesh, Nepal, northern India, Pakistan, (?) Iran, Afghanistan, and (?) Turkey.

Material examined. 83 specimens. A total of 68 specimens (11 females, 10 males, 12 male genitalia, 8 pupal exuviae, 19 larval exuviae, and 8 fourth-instar larvae) were examined from southwestern Asia — AFGHANISTAN: *Bamiyan* (Sayedabat); PAKISTAN (including areas in eastern Pakistan): (Gharian, Gujranwalia, Jhelum, Khanoharni, Lahore, Sattoki). An additional 15 specimens (3 females, 6 males, and 6 male genitalia) were examined from HONG KONG (the holotype male of *virgatipes*), INDIA (including the holotype female of *tipuliformis*), and the USSR (the lectotype male of *exilis*).

Culex (Culex) torrentium Martini

torrentium Martini, 1925: 336. +Holotype male: Schwartz River, [Thuringia], Germany; designated by Mattingly, 1955a: 31 (BM).

pavlovsky Shingarev, 1928: 52. Type specimen(s) (male): Naryn District, Roms, Siberia, USSR (TMS). Synonymy with *torrentium* by Edwards, 1932a: 110.

Culex (Culex) exilis Dyar of Martini, 1931: 386 (Palaearctic Region, A, L keys, syn., M*, F, L); Monchadskii, 1951: 260 (Middle East, L, key, syn., distr.).

Culex torrentium Martini of Zaini et al., 1983: 117 (Iraq).

Culex (Culex) torrentium Martini of Edwards, 1926: 136 (Palaearctic Region, A key, A, distr.); Senevet et al., 1957b: 92 (E. Mediterranean (?), L); Parrish, 1959: 266 (Turkey, distr.); Senevet and Andarelli, 1959: 203 (Mediterranean Basin, A, L, P keys, syn., M*, F, P*, L*, distr., biol., L assoc.); DuBose and Curtin, 1965: 352, 354 (Mediterranean area, A, L keys); Abul-hab, 1969: 249 (Iraq, L key); Lotfi, 1970: 402 (Iran); Lotfi, 1976: 73, 77, 83 (Iran, L key, ecol. note, L*); Ibrahim et al., 1983: 91 (Iraq, L key); Harbach, 1985a: 86, 94, 105 (Iran, Iraq, Turkey, distr., A, L keys).

This description is based almost entirely on specimens from Sweden.

Adult. A medium-sized species closely resembling *pipiens*, but slightly larger, with prealar scales and different male genitalia.

FEMALE. Description based on specimens from Sweden. *Head:* Antennal length about 2.2 mm; pedicel yellow or orange, mesal surface black with some tiny setae and whitish scales; flagellum normal, whorls with 6 setae, proximal part of flagellomere 1 with some tiny whitish scales on mesal surface. Proboscis mainly black-scaled, ventral surface with pale scales extending from 0.1 to 0.7 from base. Maxillary palpus usually entirely black-scaled, palpomere 4 sometimes with some indistinct pale scales on dorsomesal surface; length 0.4 mm, about 0.2 proboscis length. Falcate scales of vertex mainly pale yellow, narrower and darker laterally, whitish along margin of compound eye and on interocular space; forked scales yellow medially, black postero-

laterally; lateral spatulate scales yellowish white. Ocular setae dark reddish brown; interocular setae golden brown. *Thorax* (Fig. 2C): Pleural integument yellowish brown, faded posteriorly; scutal integument dark brown. Scutal scales uniformly golden brown with slight reddish tint, paler on anterior promontory, among supraalar setae, and on margins of prescutellar area; scales finer on fossa and supraalar area between supraalar and posterior dorsocentral setae, but not appreciably darker. Scutal setae dark reddish brown. Scutellum with fine pale yellow falcate scales; 4-7 large setae on each lateral lobe, 7 or 8 on median lobe. Antep pronotum with yellowish falcate scales in upper and lower patches, upper patch often darker, sometimes golden brown; setae dark reddish brown dorsally, becoming golden brown ventrally. Postpronotum with fine golden-brown falcate scales on dorsal 0.5, paler and slightly coarser posteriorly; with 5-10 dark setae on posterodorsal margin, longer posteriorly. Pleural setae golden brown: 7-9 upper proepisternal, 8-11 prealar, 5-7 upper mesokatepisternal, 7-11 lower mesokatepisternal, 9-12 upper mesepimeral, and 1 lower mesepimeral. Pleura with white or nearly white elongate spatulate scales in patches as follows: small patch below upper proepisternal setae, few to small patch below prealar setae, patches on upper corner and lower posterior border of mesokatepisternum, anterior patch on mesepimeron about same level and size as upper mesokatepisternal patch, and patch mainly before upper mesepimeral setae; rarely with some postspiracular scales. *Wing*: Length about 4.7 mm; length of cell R2 3.0-3.8 length of vein R2+3; subcosta intersects costa at or slightly beyond furcation of vein R2+3; length of cell M1 0.7-0.8 length of cell R2; scales entirely dark. Dorsal scaling: broad decumbent scales on costa, R and R1; narrow decumbent scales on R4+5, M3+4, mCu, CuA and proximal 0.5 of 1A; subcosta with broad semidecumbent scales; linear plume scales on Rs, R2+3, R2, R3, M, and M1+2; near-linear semiplume scales on M1, M2 and distal 0.5 of 1A; remigium with 2 distinct rows of broad decumbent scales and 2 or 3 setae distally. Ventral scaling: narrow decumbent scales on costa, subcosta, Rs, R2+3, M, M1+2, bases of M1 and M2, and distal 0.5 of 1A; linear plume scales on R1, R2, R3, R4+5, beyond bases of M1 and M2, mCu, M3+4, and CuA distal to mCu; R, CuA proximal to mCu, and proximal 0.5 of 1A without scales. *Halter*: Entirely pale, capitellum slightly darker dorsally. *Legs*: Anterior surface of forecoxa mainly black-scaled, with small patch of cream-colored scales at base and usually some scattered pale scales distally, also with many long, dark, ventrally curved setae, posterior margin with 3 or 4 shorter setae at apex, most proximal of these more or less perpendicular to surface, others project ventrally; midcoxa with midlateral longitudinal row of 4 or 5 long golden-brown setae and several shorter ones margined anteriorly by longitudinal patch of whitish spatulate scales, anterior surface with small patch of black scales and several short ventrally projecting setae at apex; posterolateral surface of hindcoxa with longitudinal row of 6-8 golden-brown setae of different lengths, anterolateral surface with narrow longitudinal row of white spatulate scales and several ventrally projecting setae at apex. Lateral surfaces of trochanters without scales, foretrochanter with black scales anteriorly and white scales posteriorly, anterior, mesal and posterior surfaces of mid- and hindtrochanters with white scales. Apices of femora with knee spots of yellowish scales; forefemur black-scaled anteriorly, white-scaled posteriorly; midfemur like forefemur but distal portion with black scales spread over dorsal surface; hindfemur with complete anterodorsal stripe of black scales, stripe gradually widening distally to cover about distal 0.5 of dorsal surface but not covering whole of anterior surface except near apex. Foretibia mainly black-scaled, with posteroventral stripe of white scales, apex with inconspicuous dorsal spot of whitish scales; anterior surface of midfemur black-scaled with some faint pale scales at apex, posterior surface white-scaled; anterior and dorsal surfaces of hindtibia black-scaled with

conspicuous spot of whitish scales at apex, posterior and ventral surfaces with whitish scales. Tarsi black-scaled, with some indistinct pale scaling posteriorly, particularly on tarsomere 1 of fore- and midlegs. Pulvilli pale. Ungues black, small, simple. *Abdomen*: Terga mainly black-scaled; tergum I golden-brown setose, with posteromesal patch of black scales; posterior and lateral margins of terga II-VIII with golden to golden-brown setae; tergum II with small basomedian yellowish spot and lateral patches of white scales; terga III-VII with yellowish basal bands and white basolateral patches, spots slightly increasing in size on succeeding posterior terga, bands of terga III-V convex and usually not reaching spots, bands of terga VI and VII reaching spots, band of VI usually straight, that of VII slightly concave; lateral scales of tergum VIII white, dorsal scales entirely yellowish or black posteriorly. Sterna II-VII mainly yellowish-scaled, with blackish scales forming a median spot or streak; sternum VIII with lateral patches of whitish scales, devoid of scales medially; all sterna golden to golden-brown setose.

MALE. Differs from female as follows. *Head*: Proboscis length about 2.4 mm; false joint 0.6 from base; ventral pale scales usually extending from 0.4 to 0.7 from base; without ventral cluster of setae at false joint. Maxillary palpus length about 3.4 mm, usually extending beyond tip of proboscis by more than length of palpomere 5; mainly dark-scaled; ventral surface of palpomeres 2 and 3 without scales, integument pale; palpomere 3 with or without some indistinct pale scaling on lateral surface, with ventrolateral row of 15-25 long setae on distal 0.33 and a complete row of short antorsely curved setae on ventromesal margin; palpomere 4 with complete or nearly complete ventral line of white scales, distal scales usually losing their color; palpomere 5 with some white scales at base ventrally; lateral and mesal surfaces of palpomeres 4 and 5 densely setose. Falcate scales of vertex of uniform size and color; forked scales less numerous and shorter, particularly posterolaterally. *Thorax*: Scutal scales slightly coarser, scales and integument between supraalar and posterior dorsocentral setae noticeably darker in dorsal view. Propleuron with 11-16 upper proepisternal setae more or less in 2 rows. *Wing*: Length about 3.9 mm; length of cell R2 2.0-2.5 length of vein R2+3; length of cell M1 0.75-0.85 length of cell R2; subcosta intersects costa before furcation of vein R2+3. *Legs*: Forecoxa without scattered pale scales distally. Anterior unguis longer than posterior unguis on fore- and midlegs, each with midventral tooth; posterior unguis of midleg smaller than posterior unguis of foreleg, both with small ventral tooth before middle; hindungues small, simple. *Abdomen*: Terga without basolateral spots; basal bands usually 0.4 tergum length (0.25-0.40); bands of terga III-V usually straight, those of terga VI and VII produced posteriorly along lateral scale-free margins, particularly on tergum VII; tergum VIII (ventral in position) pale-scaled before posteromesal setose area. Sterna II-VII frequently with dark scales confined to median area and posterolateral corners; sternum VIII (dorsal in position) pale-scaled, often with some subtle dark scales which tend to form a pair of submedial spots. *Genitalia* (Fig. 9): Form as figured; very much as in *vagans*, differing in minor details as follows. Ninth tergal lobe with 5-11 setae. Subapical lobe of gonocoxite always with 2 setae in group *d-e*; seta *g* slightly longer, rounded apically. Dorsal arm of lateral plate of phallosome broader, 0.25 distinctly twisted and curved mesad; lateral arm also broader, apical lobe with more numerous and larger spicules on posterior surface, dorsal process more strongly developed.

Pupa (Fig. 9). Character and arrangement of setae as figured; range and modal number of branches in Table 4; closely resembling *pipiens* from which it cannot be distinguished with certainty, seta 5-VI apparently stronger than in *pipiens*, trumpet exhibiting slight differences in length of tracheoid area and pinna. *Cephalothorax*: Lightly tanned, scutum, legs, and metathorax darker. Setae 1,4,6,8,12-CT usually triple,

1-CT with 2-4 branches, 4,6-CT with 3-5 branches, 8-CT with 1-4 branches and 12-CT with 2-4 branches; 2,5-CT usually with 4 branches, 2-CT with 2-5 branches and 5-CT with 3-6 branches; 3,7,11-CT usually double, sometimes triple; 9-CT double. *Trumpet*: Moderately tanned, subcylindrical, gradually widened distally; index 5.2-6.1, mean 5.5; tracheoid area darker, extending about 0.4 from base; pinna oblique, shorter than in *pipiens*, 0.5-0.7 length of tracheoid area. *Abdomen*: Lightly tanned, terga I-IV dark in middle, particularly on anterior margin; length 2.6-3.3 mm, mean 2.9 mm. Seta 1-II most often with 15 branches (12-16); 1-III-V frequently with at least 5 branches (5-9 on IV; 4-9 on V); 5-IV usually triple, sometimes with 4 branches; 5-V-VII normally double, 5-VII rarely single; 6-III-VI most often triple, 6-III,IV double or triple, 6-V with 3 or 4 branches, 6-VI usually with 3 or 4 branches, infrequently with 2 or 5 and generally longer than 6-III-V. *Genital lobe*: Tanning and length same as in *pipiens*. *Paddle*: Essentially as in *pipiens*; length 0.80-1.05 mm, mean 0.91 mm; width 0.53-0.74 mm, mean 0.63 mm; index 1.3-1.7, mean 1.5.

Larva (Fig. 10). Placement and character of setae as figured, range and modal number of branches in Table 24; extremely similar to *pipiens* and *vagans*, differing chiefly in having setae 1-III-V and 1-M more branched, also usually distinguishable from *pipiens* by the character of setae 1-T, 3-I,VII, and 1-X. *Head*: Length 0.76-0.86 mm, mean 0.83 mm; width 1.06-1.23 mm, mean 1.14 mm; moderately tanned, lateralialia slightly darker posterior to eyes; black spot area, dorsomentum and collar heavily tanned. Dorsomentum usually with 8 teeth (8-10) on either side of median tooth. Seta 7-C most often with 8 or 9 branches (8-10); 9-C usually triple (2-5). *Antenna*: Generally longer than in *pipiens*, length 0.50-0.64 mm, mean 0.57 mm; lightly tanned before seta 1-A, darker at level and distal to 1-A, base with dark spot on mesal surface. Seta 1-A with about 26 branches (21-29). *Thorax*: Seta 1-M usually double or triple, infrequently with 4 branches, length normally about 0.6 length of 3-M. Seta 1-T normally slightly longer than 0.5 length of 2-T, often with 4 branches (3-7); 2-T double. *Abdomen*: Seta 3-I,VII usually double, sometimes single on one side, seldom single on both sides; 6-I usually triple (3,4), 6-II most often with 3 or 4 branches, sometimes with 5 branches; 1-III-V usually with 4 branches, 1-VI normally triple, sum of branches for 1-III-VI always greater than for *pipiens* and *vagans*. *Segment VIII*: Comb with 31-46 scales, mean 39. Seta 1-VIII frequently with 6 branches (5-9); 3-VIII most often with 7 branches (6-9). *Siphon*: Index 4.40-5.67, mean 5.23; shape and tanning as in *pipiens*. Pecten with 10-16 spines, mode 13. Seta 1-S usually in 4 pairs; siphon often with a fifth seta 1-S on one or both sides, rarely with 3 on one side. *Segment X*: Saddle length 0.32-0.38 mm, mean 0.37 mm; siphon/saddle index 3.92-4.65, mean 4.17. Seta 1-X usually double, sometimes single on one or both sides, rarely triple; 2-X usually double, occasionally triple; 4-X in 6 pairs; anal papillae subequal, longer than saddle.

Systematics. The occurrence of *torrentium* in southwestern Asia is based on the examination of a few very poor specimens from Iran and reports from the literature. The description here is based almost entirely on material from Sweden. Although the occurrence of *torrentium* in Turkey is probably correct (see Mattingly, 1955a: 31), some doubt remains about the occurrence of this species in Iran and Iraq. Previous records from these countries are based on the identification of larvae (Lotfi, 1970, 1976; Ibrahim et al., 1983). Since it has been almost impossible to differentiate the larvae of *torrentium* and *pipiens* using previously published keys, it is not unlikely that these records actually refer to *pipiens*. I have seen only one denuded male with associated genitalia, an unassociated male genitalia, and a single fourth-instar larva from Iran, and I am not absolutely certain that these are specimens of *torrentium*. The genitalia may be those of *vagans* and the larva that of *pipiens*. These specimens are only provisionally assigned to

torrentium.

The female and larva of *torrentium* have never been easy to distinguish from *pipiens*. These species, however, are not as closely related as the outward similarity would suggest. The two species are well separated in the structure of the male phallosome. If the morphological variation observed in the different life stages of *torrentium* during this study is representative of the holomorphology of the species, then the characters mentioned in the keys should reliably distinguish most specimens of *torrentium* from *pipiens* in southwestern Asia, assuming of course that *torrentium* indeed occurs there.

Bionomics. Very little is known about the biology of *torrentium*. The immatures frequently occur with *pipiens* in Europe. Larvae are commonly found in ground pools, but are also known to occur in artificial containers such as tin cans, metal tanks, rain barrels, and concrete ornaments (Service, 1968). Harbach et al. (1985) reported their occurrence with *pipiens* in an old boat. This species apparently tolerates some organic matter and salt in its breeding sites. Collections have been made in rock pools in which the water was dark brown with decaying leaves (Ribeiro et al., 1977) and in ground pools with salinities of 0.3-0.4 that of sea water (Lever, 1954). Females are not attracted to man and apparently feed on birds (Callot, 1957; Service, 1968).

Distribution. This species is widely distributed in Europe and western Asia, including Turkey, (?) Iran, and (?) Iraq.

Material examined. 449 specimens. Only 4 specimens (1 male, 2 male genitalia, and 1 fourth-instar larva) were examined from southwestern Asia — IRAN: (Kivi, Sarab-bahran Kazeroon). A total of 445 specimens (73 females, 71 males, 36 male genitalia, 140 pupal exuviae, 102 larval exuviae, and 23 fourth-instar larvae) were examined from EAST GERMANY (the holotype male, allotype female, and 2 paralectotypes), PORTUGAL, SWEDEN, and WEST GERMANY.

Culex (Culex) decens Theobald

decens Theobald, 1901c: vii. +Lectotype male, hereby designated, bearing following data: "Bonny [Nigera] / 29 V 00 // Type // Culex / decens / (Type). Theobald.", genitalia on acetate strip (BM).

masculus Theobald, 1901b: 125. +Lectotype male, hereby designated, bearing following data: "Wilberforce, / Free Town. / 3. 9. 99. / Fr. larva in / wood-side puddle. // Type // Free Town. / Sierra Leone. / IX. 99. / E.E. Austen. 99. 267. / Culex / masculus / (Type) Theobald"; genitalia on acetate strip (BM). Synonymy with *decens* by Edwards, 1911: 263.

minutus Theobald, 1905c: 30. +Lectotype male, hereby designated, bearing following data: "Type // Transvaal / Dr. Simpson // Culex / minutus. / (Type). F.V.T. // Recd. from / F.V. Theobald / 1907-29."; genitalia on acetate strip (BM). Synonymy with *decens* by Edwards, 1911: 263.

nigrocostalis Theobald, 1909: 16. +Lectotype male, hereby designated, bearing following data: "Accra / 7-6-08 / c in latrine / WMG // Culex / nigrocostalis / Type. [male symbol]. F.V.T / 30. 3. 09. // Accra, / Gold Coast, / W. Africa. / 7-VI. 1908. / Dr. W.M. Graham. / 1909-271."; genitalia on acetate strip (BM). Synonymy with *decens* by Edwards, 1911: 263.

lividocostalis Graham, 1910: 269. +Lectotype male, hereby designated, bearing following data: "Yaba / 3-7-09 / fr. larvae / No 16 / WMG // Type // Yaba, / Lagos, / W. Africa. / 3. VII. 1909. / D.W.M. Graham. / 1910-80."; genitalia on acetate strip (BM). Synonymy with *decens* by Edwards, 1911: 263.

Culex decens Theobald of Edwards, 1912c: 381 (Africa, L key); Edwards, 1913b: 58 (Africa, M gen.).

Culex (Culex) decens Theobald of Edwards, 1941: 336, 425, 484 (Afrotropical Region, A key, M*; F*; P*, syn., distr.); Lewis, 1943a: 282 (Eritrea, L bionomic note); Lewis, 1943b: 72 (Sudan, A beh.); Lewis, 1945: 21 (Sudan, distr.); Abbott, 1948: 45 (Sudan, L habitat); Lewis, 1948: 144 (Sudan, L habitat); Hopkins, 1952: 320 (Afrotropical Region, L*, bionomics); Knight, 1953a: 229 (Yemen Arab Republic, A, L, distr.); Lewis, 1956: 715 (Sudan, distr.); Mattingly and Knight, 1956: 110, 113, 120, 127-128, 132 (P.D.R. Yemen, Yemen Arab Republic, A, L keys, distr., zoogeogr., bionomics); Mekuria, 1968: 78 (Ethiopia); Harbach, 1985a: 86, 94, 103 (P.D.R. Yemen, Yemen Arab Republic, distr., A, L key).

Adult. *Culex decens* is distinguished from all other species of the subgenus *Culex* occurring in southwestern Asia by the following combination of characters: (1) proboscis entirely dark-scaled, (2) scutal scales uniform golden brown with reddish tint, (3) abdominal sterna with broad apical black bands, and (4) maxillary palpus of male completely dark-scaled. Specimens examined from the Sudan and Uganda differ from Arabian material in having finer scutal scales which are more evenly dispersed and darker in color.

FEMALE. *Head:* Antennal length 1.6-2.0 mm, mean 1.8 mm; entirely dark. Proboscis length 1.8-2.0 mm, mean 1.9 mm; entirely clothed in brownish-black scales, ventral surface slightly paler; labella yellowish brown. Maxillary palpus entirely dark-scaled; length about 0.4 mm, approximately 0.2 of proboscis length. Forked scales of vertex dark; falcate scales pale yellow; lateral spatulate scales off-white; with 2 very long interocular setae projecting downward over clypeus. *Thorax:* Integument brown, pleura paler. Scutum mainly with golden-brown scales with reddish tint, with pale yellow or whitish scales on anterior and lateral margins and prescutellar area (scutum of Sudanese and Ugandan specimens with finer, more evenly dispersed, uniform reddish-brown scales; without distinctly paler scales at margins); setae dark reddish brown, prominent. Scutellum with pale yellow falcate scales on all 3 lobes; 3 or 4 large dark setae on each lateral lobe, 5-8 on median lobe. Anteprenotum with rather broad pale yellow falcate scales and dark setae, setae longer anteriorly; postpronotum with pale yellow to golden-brown falcate scales somewhat intermediate in form between scutal and anteprenotal scales, usually with 4 (sometimes more) well-developed setae in row along posterior margin at level of mesothoracic spiracle. Pleura with creamy-white spatulate scales as follows: patch below and mesal to upper proepisternal setae, patches on upper corner and lower posterior border of mesokatepisternum, and anterior and upper patches on mesepimeron, upper mesepimeral patch larger than in most species, these scales being among and around the upper mesepimeral setae; numbers of pleural setae: 7-11 proepisternal, 7-12 prealar, 5-9 upper mesokatepisternal, 10-14 lower mesokatepisternal, 7-13 upper mesepimeral, and 1 (rarely 2) lower mesepimeral. *Wing:* Length 3.3-3.6 mm, mean 3.5 mm; length of cell R₂/length of vein R₂₊₃ 2.4-3.0, mean 2.6; length of cell M₁ 0.8-1.0 length of cell R₂; entirely dark-scaled. *Halter:* Pale brown. *Legs:* anterior surface of forecoxa dark-scaled, dark scales continuous with

patch of creamy-white spatulate scales at base, coxa with few pale yellow spatulate scales posterolaterally at apex; mid- and hindcoxae with longitudinal patch of creamy-white spatulate scales on anterior side of lateral midline. Posterior surface of trochanters with small, pale yellow spatulate scales. Femora with narrow pale knee spots; forefemur dark-scaled anteriorly, pale-scaled posteriorly; midfemur dark-scaled anteriorly and dorsally, pale-scaled posteroventrally; hindfemur largely pale-scaled, with more or less complete dorsal stripe of dark scales that widens distally onto anterior and posterior surfaces. Foretibia mainly dark-scaled, paler ventrally, with pale spot anterodorsally at apex; midtibia also mainly dark, paler posteriorly, with spot of pale scales dorsally at apex; hindtibia like foretibia but with prominent spot of pale scales at apex. Tarsi entirely dark-scaled. *Abdomen*: Tergum I with posteromedial patch of brownish scales; terga II-VII brown with narrow basal pale bands of off-white scales connected to large lateral spots of same color, bands 0.01-0.25 tergum length; tergum VIII with narrow basal pale band. Sterna II-VII with broad apical black bands; sternum VII with pale scales laterally, without scales medially.

MALE. Differing from female as follows. *Head*: Maxillary palpus entirely dark; palpomere 3 with 7-10 ventral setae at apex; palpomeres 4 and 5 densely setose. Falcate scales of vertex less numerous and paler in color. *Thorax*: Scutal scales paler and longer. *Wing*: Length 3.0-3.2 mm, mean 3.1 mm; length of cell R2 1.8-1.9 length of vein R2+3; length of cell M1 0.7-0.9 length of cell R2; scales usually paler, particularly along anterior veins. *Abdomen*: Terga essentially as in female, terga without basolateral pale spots, basal bands produced posteriorly along lateral scale-free margins; tergum VIII (ventral in position) mainly dark-scaled, with narrow basal pale band, posterior margin slightly emarginate, densely setose, posterolateral setae very long. Apical dark bands of sterna II-VII broader, more or less convex, proximal sterna with only basolateral corners pale-scaled; sternum VIII (dorsal in position) usually nearly completely pale-scaled, caudal margin narrowly dark-scaled, particularly in middle. *Genitalia* (Fig. 11): Ninth tergal lobe small, with 9-17 setae (mode 10) in 1 or 2 irregular rows. Gonocoxite normal, ventrolateral setae strongly developed, longer and stouter than lateral setae, mesal surface with 4 irregular rows of small setae extending from base to level of subapical lobe; subapical lobe indistinctly divided, setae *d-f* borne on slight prominence on mesal side of main lobe; setae *a-c* rodlike, *a* shorter than *b* and *c* and more or less straight, *b* and *c* each with stout base, tapered and slightly curved, *b* slightly stouter than the others; 3 setae in group *d-e*, 2 simple, 1 flattened and resembling *f*; *f* longer than *d-e*, flattened, slightly broader distally; *g* foliform, broad and strongly asymmetrical; *h* long, slender, bent in middle. Gonostylus slender, curved, slightly widened before tip on lateral side, tip rugose dorsally. Phallosome not much longer than broad, lateral plates slightly longer than aedeagus; dorsal arm long, tip pointed and bent mesad, diverging from its mate of the opposite side; lateral arm with 3-5 denticles (mode 4) in more or less straight line on mesal side of caudal margin, also with a prominent flat lateral lobe, a short conical dorsal process, and a weak basal articulatory process; ventral arm a sinuous mesal process with tip pointed and bent caudad. Aedeagus semispherical; ventral aedeagal bridge narrow. Proctiger normal; paraproct with long curved basal lateral arm, crown dark with numerous short spinelike spicules and some shorter simple blades. Cercal sclerite elongate, irregular in shape; 3-5 cercal setae, usually 4. Tergum X straplike, joining base of paraproct below basal lateral arm.

Pupa (Fig. 11). Character and positions of setae as figured, range and modal number of branches in Table 5; similar to *pipiens* and closely related species, the most obvious distinctions being the form of the trumpet, which is long and slender, and the character of seta 1-II, which has at least 25 branches. *Cephalothorax*: Setae 3,4-CT

usually triple, sometimes with 4 branches; 6-CT with 3 or 4 branches, more often with 4; 12-CT usually with 3 or 4 branches (3-5). *Trumpet*: Long and slender, index 5.5-9.1, mean 7.1; tracheoid area about 0.4 trumpet length; pinna 0.15-0.25 trumpet length. *Abdomen*: Length 2.6-2.9 mm, mean 2.8 mm. Seta 1-II with 25 or more branches, usually more (25-32); seta 5-IV of same order of thickness and length as 5-V, VI, with 3 or 4 branches, more often with 3; 6-III double or triple, more often double, 6-IV-VI usually triple, sometimes with 4 branches, rarely double. *Genital lobe*: Rather short in male, length about 0.33 mm. *Paddle*: Length 0.74-0.92 mm, mean 0.82 mm; width 0.48-0.60 mm, mean 0.57 mm; index 1.3-1.5, mean 1.4.

Larva (Fig. 12). Placement and character of setae as figured, range and modal number of branches in Table 25; immediately distinguished from all other *Culex* in southwestern Asia by the long, slender siphon and very long, single seta 1-IV, V. *Head*: Length 0.70-0.81 mm, mean 0.76 mm; width 1.00-1.21 mm, mean 1.13 mm; lightly tanned, darker behind eyes, dorsal apotome sometimes with small dark median spot posterior to bases of seta 5-C, less frequently with a pair of dark sublateral spots before median spot. Dorsomentum moderately tanned; usually with 8 teeth (6-8) on either side of median tooth, lateral teeth longer. Seta 0-C well developed, distinct; 1-C lightly to moderately tanned, tapered to sharp point, length less than 0.1 mm; 2-C absent; 5, 6-C double, 5-C seldom triple; 7-C usually with 6 or 7 branches (5-7); 14-C normally double with strongly divergent branches (1-3). *Antenna*: Length 0.52-0.61 mm, mean 0.55 mm; lightly tanned, distal part darker, base with dark spot on mesal surface. Seta 1-A with about 27 branches (21-32). *Thorax*: Seta 7-P triple. Seta 1-M usually single, seldom double, short, about 1.5 length of 2-M; 9-M with 3 or 4 branches, more often with 4. Seta 1-T usually single, sometimes double; 2-T normally double (1, 2). *Abdomen*: Seta 3-I, VII double, 3-VII rarely triple; 6-I, II triple, 6-III, V, VI single; 6-IV normally double (1-3); 1-III, VI developed as usual, 1-III either single, double or triple, 1-VI usually triple, sometimes double; 1-IV, V strongly developed, single and very long, much longer than length of 2 abdominal segments. *Segment VIII*: Comb with 43-65 scales, mean 52. *Siphon*: Very long and slender, index 8.75-11.27, mean 9.96; lightly to moderately tanned. Pecten on basal 0.2, with 11-16 spines, mode 14; larger spines with 4 or 5 denticles. Seta 1-S usually in 4 pairs (a fifth seta occasionally occurs on one or both sides of siphon), usually double or triple (1-3), length about same as diameter of siphon at point of attachment. *Segment X*: Saddle lightly to moderately tanned; length 0.36-0.48 mm, mean 0.39 mm; siphon/saddle index 5.43-7.20, mean 6.36. Seta 1-X usually double, occasionally single. Anal papillae subequal, slightly shorter than saddle.

Systematics. I am recognizing *decens* as the nominotypical member of a subgroup which includes *invidiosus* Theobald, 1901c, *antennatus*, *ornatothoracis* Theobald, 1909, *trifolius* Edwards, 1914a, *perfuscus* Edwards, 1914a, *perfidiosus* Edwards, 1914a, *telesilla* De Meillon and Lavoipierre, 1945 (in De Meillon et al., 1945) and *litwakae* Harbach, 1985b. Except for *antennatus*, the members of this group are restricted to the Afrotropical Region. The group as a whole is poorly known and it may be necessary to divide it into two or more subgroups when the species are studied in detail. The subgroup is recognized primarily on the basis of overt similarities in adult ornamentation and the structure of the male genitalia. There appear to be some striking differences in the larvae.

The occurrence of *decens* in southwestern Asia (the Yemen Arab Republic) was first recorded by Knight (1953a) who noted that Yemenite material resembles the African material examined by Edwards (1941) except that the ventral surface of the proboscis and the scutal scaling are lighter in some specimens. I have noticed that the scutal scales of some specimens are slightly coarser and without the distinct reddish tint found

in specimens from Sudan and Uganda.

The larva of *decens* is quite different from other *Culex* occurring in southwestern Asia. It is easily recognized by the long, slender siphon and the long, single seta 1-IV,V. Hopkins (1952) did not mention seta 1-IV,V in his description of *decens* so it is possible that this character may serve to distinguish *decens* from *invidiosus*, a species which is supposedly indistinguishable from *decens* in Africa. Seta 1-IV,V is similarly developed in larvae of *decens* examined from several African countries. No specimens identified as *invidiosus* were examined during this study.

Bionomics. Larvae of *decens* have been taken from ground waters, such as pools, swamps, rock holes, ditches, and streams, and a variety of artificial containers, including cement basins, tubs, drains, wells, troughs, and household pots. The early reports of *decens* breeding in tree holes, cut bamboo, and crabholes probably refer to another species. This species has been collected in association with *laticinctus* and *Culex (Lutzia) tigripes* De Grandpre and De Charmoy in the Yemen Arab Republic (Knight, 1953a). Collection data seen during this study indicate that resting adults have been collected in a house and an unused well. Lewis (1943b) observed that *decens* is common in the Anglo-Egyptian Sudan, but is never seen biting man. Lumsden and van Someren (1953) reported that a single female was collected during landing catches made 11 m above the ground in riverain forest in Uganda. This species probably is not involved in disease transmission.

Distribution. *Culex decens* is very widely distributed in the Afrotropical Region.

Material examined. 129 specimens. A total of 50 specimens (8 females, 9 males, 11 male genitalia, 9 pupal exuviae, 10 larval exuviae, and 3 fourth-instar larvae) were examined from southwestern Asia — P.D.R. YEMEN: (Mukalla); YEMEN ARAB REPUBLIC: (Ta'izz). An additional 79 specimens (17 females, 18 males, 15 male genitalia, and 29 fourth-instar larvae) were examined from GHANA (type specimens of *nigrocostalis*), IVORY COAST, KENYA, LIBERIA, MAURITANIA, NIGERIA (type specimens of *decens* and *lividocostalis*), SENEGAL, SIERRA LEONE (including the type series of *masculus*), SOUTH AFRICA (the type male of *minutus*), SUDAN, UGANDA, and ZAIRE.

Culex (Culex) antennatus (Becker)

antennatus Becker, 1903: 68 (*Anopheles*). Type specimen(s) (male): Cairo, Egypt (ZM).

laurenti Newstead, 1907 (in Newstead et al., 1907: 24). +Lectotype male, hereby designated, bearing following data: "SYN- / TYPE // COTYPE / [male symbol] // SCHOOL OF TROP. MED., / LIVERPOOL UNIVERSITY / *Culex laurenti*. / Leopoldville, / Belgian Congo, / December 1903. / Drs. Dutton & / Todd // SYNTYPE of / *Culex laurenti* / Newstead / det. J. Chainey 1975"; genitalia on acetate strip (BM). Synonymy with *antennatus* by Hopkins, 1936: 224.

Culex antennatus (Becker) of Lewis, 1945: 20 (Sudan, distr.); Theodor, 1952: 113 (Middle East, zoogeogr.); El-Said and Kenawy, 1983a (Egypt, distr.); Zimmerman et al., 1985: 84 (Egypt, bionomics); Kitron and Pener, 1986 (Israel, L bionomics).

Culex (Culex) antennatus (Becker) of Edwards, 1941: 333, 425, 484 (Afrotropical Region, A key, M*; F*; P, distr.); Lewis, 1943b: 72 (Sudan, A beh.); Lewis, 1948: 145-148 (Sudan, A beh., L habitat); Hopkins, 1952: 320 (Afrotropical Region, L

key, L, bionomics); Lewis, 1956: 715 (Sudan, distr., zoogeogr.); Ovazza et al., 1956: 176 (Ethiopia); Senevet et al., 1957b: 92 (North Africa, L); Senevet and Andarelli, 1959: 215 (North Africa, A, P, L keys, syn., M*, F, P*, L*, distr., biol., L assoc.); DuBose and Curtin, 1965: 352, 354 (Mediterranean area, A, L keys); Mekuria, 1968: 77 (Ethiopia, distr.); Lotfi, 1970: 401 (Iran); Margalit and Tahori, 1970b: 151 (Israel, coll. sites); Margalit and Tahori, 1974: 56 (Israel, coll. rec.); Lotfi, 1976: 73, 76, 82 (Iran, L key, ecol. note, L*); El-Said and Kenawy, 1983b (Egypt, distr.); Harbach, 1985a: 86, 94, 104 (Egypt, Iran, Israel, Egypt, distr., A, L keys).

Culex (?) *invidiosus* Theobald of Gough, 1914: 135 (Egypt, bionomic note, coll. sites).

Culex invidiosus Theobald of Storey, 1918(1919): 100 (Egypt, A, L keys, A, bionomics).

Culex laurenti Newstead of Buxton, 1923: 317 (Israel, Jordan, coll. rec.); Kirkpatrick, 1924(1925): 369, 372 (Egypt, A, L keys); Salem, 1938: 27 (Sinai); Abdel-Malek, 1956: 105 (Sinai, L key).

Culex (*Culex*) *laurenti* Newstead of Edwards, 1921: 344 (Egypt, Israel, Jordan, A key, tax., distr.); Séguy, 1924: 39, 190 (Egypt, Israel, Jordan, A key, M*, F, tax., distr., syn.); Kirkpatrick, 1925: 129 (Egypt, A, P, L keys, M*, F, P*, L*, bionomics); Edwards, 1926: 141 (Egypt, Israel, Jordan, A, L keys, A, distr.); Stackelberg, 1927: 164 (Middle East, M, F keys, A, M gen.*, distr.); Martini, 1931: 370 (Egypt, Jordan, A, L keys, M*, F, L*, distr.); Monchadskii, 1951: 265 (Middle East, L key, L*, bionomics, distr., syn.).

Adult. A small pale brown species easily recognized by the prominent lateral pale stripes on abdominal terga VI and VII and lateral pale spots on the other terga. The proboscis of the male bears a ventral cluster of setae near the middle. This species superficially resembles *pusillus* Macquart of the subgenus *Barraudius*, but the abdominal terga of the latter are darker, black or nearly so, and the proboscis of the male lacks a midventral cluster of setae.

FEMALE. *Head:* Antenna blackish; pedicel with some tiny scales and/or setae on mesal side. Proboscis dark-scaled dorsally, with paler scaling ventrally, particularly on distal 0.5; length 1.6-1.8 mm, mean 1.7 mm. Maxillary palpus dark-scaled, darker at tip; length approximately 0.2 proboscis length. Forked scales of vertex numerous, usually dark; falcate scales pale yellowish white; lateral spatulate scales narrow, white. *Thorax:* Scutum brown; uniformly clothed in fine, golden-brown falcate scales, with some pale yellow or whitish scales on anterior promontory and prescutellar area. Scutellum with very fine pale yellow falcate scales on lateral and median lobes. Pronotum brown; antepnotum with fine pale yellow falcate scales; similar scales on postpronotum but slightly darker anteriorly. Pleura brownish yellow; numbers of pleural setae: 6-12 upper proepisternal, 6-9 prealar, 4 or 5 upper mesokatepisternal, 5-9 lower mesokatepisternal, 5-8 upper mesepimeral, and 1 lower mesepimeral; patches of narrow cream-colored spatulate scales present as follows: small patch below upper proepisternal setae, upper and lower patches on mesokatepisternum, and anterior and upper patches on mesepimeron. *Wing:* Length 2.7-3.0 mm, mean 2.9 mm; infrequently with some pale scales on posterior side of costa before humeral crossvein, otherwise entirely dark-scaled; length of cell R2 approximately 4.5 length of vein R2+3; length of cell M1 about 0.8 length of cell R2. *Halter:* Pale, more or less same color as pleura. *Legs:* Anterior surface of forecoxa with dark scales in middle, off-white scales at base and apex; mid- and hindcoxa each with longitudinal patch of small cream-colored scales on anterior side of lateral midline. Forefemur dark brown-scaled anteriorly, pale-scaled posteriorly, with inconspicuous knee spot of yellow scales; midfemur same but dark brown scaling of

anterior surface gradually expanded over dorsal surface on distal 0.5; hindfemur mainly pale-scaled, with dorsal line of dark scales (often faint proximally; widened distally, particularly on distal 0.5) and narrow yellow knee spot (usually more distinct than on fore- and midfemora). Foretibia dark brown to blackish-scaled dorsally, with off-white scales ventrally; anterior surface of midtibia dark brown-scaled, posterior surface with yellowish white scales; hindtibia same as foretibia but sometimes with faint apical spot of pale scales. All tarsi dark-scaled, somewhat paler scaling ventrally. *Abdomen*: Tergum I with inconspicuous median posterior patch of cream-colored scales; terga II-VII almost entirely brown-scaled; terga II-V with small basolateral patches of cream-colored scales which are usually not visible in dorsal aspect, those of tergum V sometimes partly visible; lateral borders of terga VI and VII with stripes of cream-colored scales; tergum VIII largely pale-scaled. Sterna with cream-colored scales; sternum VIII with lateral patches only, median area without scales.

MALE. Like female except as follows. *Head*: Ventral surface of proboscis usually entirely pale-scaled, conspicuously so on distal 0.5; with ventral cluster of setae on proximal side of false joint; length 1.7-1.9 mm, mean 1.8 mm. Maxillary palpus dark, palpomeres 4 and 5 darker; length about 1.3 proboscis length, extending beyond tip of proboscis by length of palpomere 5; palpomere 3 with lateral patch of pale scales before apex; ventral surface of palpomere 4 with spot of white scales at base and short line of similar scales before apex, these sometimes joined; palpomere 5 noticeably longer than 4 (about 1.4 length of 4), with spot of white scales ventrally at base. Lateral spatulate scales of head slightly smaller and more numerous. *Thorax*: Scutal scales slightly finer. *Wing*: Length 2.5-3.0 mm, mean 2.8 mm; length of cell R2 about 1.6 length of vein R2+3. *Abdomen*: Terga II and III normally entirely dark-scaled; tergum VIII (ventral in position) and sternum VIII (dorsal in position) largely or completely with cream-colored scales. *Genitalia* (Fig. 13): Form as figured; basic structure as in *decens*, differing chiefly as follows. Ninth tergal lobe with 6-14 setae (mode 8). Subapical lobe of gonocoxite with 3 setae in group *d-e*, 2 longer setae with apical series of 2 or 3 (usually 3) recurved projections, shorter seta simple and slightly flattened; seta *g* much as in *decens*, acuminate. Gonostylus broader distally. Phallosome longer than broad with lateral plates slightly longer than aedeagus; dorsal arm slightly sinuous in lateral view; caudal margin of lateral arm with tight row of 3-5 denticles (usually 4) projecting over prominent lateral ridge, end of ridge differentiated as a conspicuous dorsal process with narrowed and slightly bent apex, ventral arm without prominent flat lateral lobe, basal articulatory process more strongly developed; ventral arm a prominent rounded ventrocaudal lobe with a short dorsally directed hornlike projection, ventrocaudal surface with many minute spinules, dorsal projection slightly bent caudad and resembling denticles of lateral arm in dorsal view. Aedeagus conical; ventral aedeagal bridge slightly broader. Basal lateral arm of paraproct shorter, flattened, and broad. Cercal sclerite usually with 2 setae (1-3) on posterolateral corner.

Pupa (Fig. 13). Character and positions of setae as figured, range and modal number of branches in Table 6; resembling *pipiens* in most respects, but generally smaller and setae 3-VII and 6-III with more branches; extremely similar to members of the *univittatus* and *simpsoni* subgroups, from which it cannot be distinguished with confidence. *Cephalothorax*: Seta 5-CT frequently with 5, 6, or 7 branches (4-8); 8-CT frequently with 6 or 7 branches (4-9); 9-CT often with 3 branches (2-4); 12-CT often with 5 branches (2-5). *Trumpet*: Much as in *pipiens*, index 4.3-6.5, mean 5.2; tracheoid area about 0.4 trumpet length; pinna oblique, 0.2-0.3 trumpet length. *Abdomen*: Length 2.6-3.3 mm, mean 2.9 mm. Seta 1-II with considerable variation in number of branches (7-41); 5-IV not developed quite as strongly as 5-V, VI, often with 5 branches (4-6); 6-III,

IV most often with 3 or 4 branches (3-6), 6-V,VI most often with 5 or 6 branches (3-6). *Paddle*: Length 0.80-1.01 mm, mean 0.90 mm; width 0.56-0.70 mm, mean 0.63 mm; index 1.3-1.5, mean 1.4.

Larva (Fig. 14). Placement and form of setae as figured, range and modal number of branches in Table 26; differing from *pipiens* and allied species and resembling *univittatus* and *perexiguus* in having seta 5-C usually double or triple, seta 6-VI normally single, and seta 1-S no longer than diameter of siphon. *Head*: Length 0.64-0.75 mm, mean 0.67 mm; width 1.02-1.16 mm, mean 1.10 mm; tanning, including spots on dorsal apotome, almost exactly as in *pipiens*. Dorsomentum usually with 8 teeth (7-9) on either side of median tooth. Seta 1-C long, slender, moderately tanned, length about 0.1 mm; 2-C absent or represented by a small bump; 5,6,11-C double or triple; 7-C with 6, 7, or 8 branches occurring in nearly equal frequencies; 10-C usually triple, sometimes with 4 branches; 14-C single or double, branches strongly divergent when double. *Antenna*: Length 0.44-0.58 mm, mean 0.50 mm; moderately tanned at base and on distal part from just before seta 1-A; spicules rather broad, not true aciculae; scape developed; puncture not evident. Seta 1-A with about 20 branches (17-28). *Thorax*: Seta 7-P triple. Seta 1-M most often double, frequently triple, sometimes single, very short, about same length as 2-M. Seta 1-T short, about same length as 1-M, usually double or triple (1-3); 2-T double or triple. *Abdomen*: Segments III and V with black pigment granules giving abdomen a 2-banded appearance to the unaided eye. Seta 3-I usually triple (2-5), 3-VII usually with 4 or 5 branches (3-5); 6-I,II normally triple, 6-II occasionally with 4 branches, 6-III usually double (1-3), 6-IV triple, 6-V double or triple, more often double, 6-VI single; 1-III with 3 or 4 branches, 1-IV-VI usually triple, 1-IV,V seldom with 4 branches, 1-V,VI sometimes double. *Segment VIII*: Comb with 32-46 scales, mean 38. *Siphon*: Long, slender, slightly tapered; index 5.47-8.14, mean 6.78. Pecten on approximately basal 0.25, with 10-14 spines, mode 13; larger spines with 2 or 3 basal denticles. Seta 1-S normally in 5 or 6 pairs, 2 or 3 posterolateral and 3 lateral, length about 0.5 diameter of siphon at point of attachment. *Segment X*: Saddle length 0.36-0.40 mm, mean 0.38 mm; siphon/saddle index 3.77-4.99, mean 4.35. Seta 1-X with 3 or 4 branches, more often with 4; seta 2-X double or triple, more often double. Anal papillae subacutely tapered, about length of saddle.

Systematics. *Culex antennatus* is an interesting species which shares some features with the adults of both the *pipiens* and the *decens* subgroups. It is included as a member of the *decens* subgroup because the male genitalia suggest a closer affinity with *decens* than *pipiens*. The larva of this species bears a close resemblance to those of *univittatus* and *perexiguus* which suggests a relationship with these species. It is possible, therefore, that *antennatus* has retained some generalized features of an ancestral stock which may have given rise to the *pipiens*, *decens* and *univittatus* subgroups. There is some suggestion of a distant relationship with members of the *sitiens* group in the structure of the male phallosome. Once the *Culex* fauna of Africa has been studied thoroughly and species affinities are more clearly understood, it may be necessary to include *antennatus* and the closely related *litwakae* Harbach, 1985b, in a separate subgroup.

The adults of *antennatus* are superficially very similar to those of *Culex* (*Barraudius*) *pusillus* Macquart, 1850, but are easily distinguished by the smaller forefemur/proboscis ratio and the much longer hindtarsomere 1. These species are sympatric throughout the range of *antennatus* in southwestern Asia and Egypt. Females of *antennatus* are almost indistinguishable from unbanded females of *pipiens*, but the males, larvae, and pupae of these species are easily differentiated. The larva of *antennatus* is extremely similar to that of *perexiguus* which usually, but not always, dif-

fers in the character of setae 1-C, 1-M, and 1-S. Live larvae of *antennatus* are readily distinguished from those of *perexiguus* by the two-banded appearance of the abdomen.

Bionomics. *Culex antennatus* mainly breeds in stagnant bodies of fresh water, but is sometimes found in brackish water pools. It rarely occurs in polluted water. Common larval habitats include rice fields, stream pools, springs, ponds, swamps, ditches, seepages, and animal footprints. The breeding places usually contain emergent vegetation. Larvae are often found in association with *theileri*, *poicilipes*, *perexiguus*, and *pipiens*. Females feed on mammals. They appear to feed primarily on bovids, but also attack sheep, goats, horses, donkeys, and man (Zimmerman et al., 1985). The species bites both indoors and outdoors in the evening, and seeks resting sites away from buildings (Lewis, 1948; Zimmerman et al., 1985). *Culex antennatus* has been found naturally infected with West Nile virus in Egypt (Taylor et al., 1953; Taylor et al., 1956) and Rift Valley Fever virus in Nigeria (Lee, 1979). Successful experimental transmission has been demonstrated for both of these viruses in the laboratory (Taylor et al., 1953; Gad et al., 1987, respectively). Arumowat virus was isolated from a pool of unfed females in the Sudan (Karabatsos, 1985), and there is serological evidence for human infection of this virus in Egypt, Sudan, and Somalia (Tesh et al., 1976). Immature filarial infections have been found in this species in Tanzania (Smith, 1955) and Egypt (A. Gad, personal communication).

Distribution. This species occurs in the Middle East and the Afrotropical Region south to Botswana.

Material examined. 885 specimens. A total of 849 specimens (211 females, 175 males, 13 male genitalia, 310 pupal exuviae, 112 larval exuviae, and 28 fourth-instar larvae) were examined from southwestern Asia — EGYPT: *Aswan* (Aswan, El Aqaba el Saghira, Ezbet el Silsila, Khour Abu Subeira, Nag el Kagug, Nag el Ritag el Qibli), *Asyut* (Beni Shiqeir, El Qusiya), *El Fayyum* (Abhit el Hagggar, Birket Qarum, Biyahmu, El Nazla, Sinero el Bahria, Tubhar, unknown localities), *El Foadia* (Baltim, Nimra el Basal), *El Gharbiya* (Saft Turab), *El Giza* (Ezbet Bosna Sharawy, Harania, Koniessa, Nazlet el Ashtar, Talbia), *El Isma'iliya* (Abu Khalifa, Nifisha), *El Qahira* (Cairo), *El Qalyubiya* (Bahtim, El Salmaniya, Ga'afara, Kaha, Kafr Hamza, Sindiwa), *El Sharqiya* (Inshas el Raml, Khirbetrama), *Kafr el Sheikh* (Kafr el Sheikh, Makallet el Qasab); IRAN: (Bisotun, Kamroud, Kernianshah); IRAQ: (unknown localities); ISRAEL: (Lake Tiberias, Ludd, Rosh Hal Ayn, many unknown localities); JORDAN: (Az Zarqa, unknown localities); TURKEY: (unknown localities). An additional 36 specimens (18 females, 7 males, 9 male genitalia, 1 pupal exuviae, and 1 larval exuviae) were examined from ALGERIA, MAURITANIA, SENEGAL, SUDAN, TUNISIA, ZAIRE (type specimens of *laurenti*), and an unknown country.

Culex (Culex) univittatus Theobald

univittatus Theobald, 1901b: 29. +Lectotype female: Salisbury, Zimbabwe; designated by White, 1975: 321 (BM).

simplex Theobald, 1903a: 337 (*Heptaphlebomyia*). +Holotype female: Salisbury, Rhodesia (BM). Synonymy with *univittatus* by Edwards, 1911: 262.

montforti Ventrillon, 1905a: 448 (*Heptaphlebomyia*). +Lectotype male: Andajobé, Madagascar; designated by White, 1975: 321 (BM). Synonymy with *univittatus* by Edwards, 1911: 262.

ataeniatus Theobald, 1911: 261. +Holotype female: Onderstepoort, Transvaal (BM). Synonymy with *univittatus* by White, 1980: 137.

Culex univittatus Theobald of Edwards, 1912b: 28, 32 (in part; Afrotropical Region, A key, distr.); Edwards, 1912c: 381 (in part; Africa, L key); Edwards, 1913b: 58 (in part; Africa, A, M gen.); Edwards, 1914a: 67 (Africa, M gen.*); Mattingly, 1954: 56 (typical form, in part; Africa, zoogeogr., M gen.*).

Culex (Culex) univittatus Theobald of Séguy, 1924: 39, 190 (in part; Africa, tax., M gen.*, distr.); Edwards, 1941: 306, 419, 482 (typical form, in part; A key, M*, F*, P, syn., distr.); Lewis, 1943a: 282 (in part; Eritrea, coll. rec.); Hopkins, 1952: 291 (? in part; Afrotropical Region, L); Mattingly and Knight, 1956: 104, 122 (in part; Yemen Arab Republic, A, L keys); Jupp, 1970: 9-16 (in part, Highveld form; South Africa, M*, F, distr., crossmatings, beh.); Jupp, 1971: 339-356 (South Africa, M gen.*, F*, distr., crossmatings); Jupp, 1972 (excluding short-spined form; Africa, M gen.*, F); White, 1975: 320-322 (Afrotropical Region, syn., distr., A key); Harbach, 1985a: 86, 93, 104 (P.D.R. Yemen, Yemen Arab Republic, distr., A, L keys).

Culex (Culex) univittatus var. *neavei* Theobald of Knight, 1953a: 232 (Yemen Arab Republic, coll. rec.).

The description of this species is based largely on the examination of topotypic material and the type series. The occurrence of *univittatus* in southwestern Asia is based on the examination of a single male from the P.D. R. Yemen and a single female from the Yemen Arab Republic.

Adult. This species might be confused with *sinaiticus* or *simpsoni*, but differs in the character of the scutal scaling and by the presence of an anterior pale stripe on the hindtibia. It is closely allied to *perexiguus* from which it is usually distinguished by the presence of a complete anterior pale stripe on the midfemur, and a line of scales on vein 2A in the female, and slightly different genitalia in the male.

FEMALE. *Head:* Length of antenna 1.5-1.9 mm, mean 1.7 mm; pedicel pale laterally, dark mesally with patch of white scales; flagellum dark, flagellomere 1 with some white scales mesally just above base, most flagellar whorls with 4 long dark setae. Proboscis black-scaled, with whitish scales ventrally in middle; length 1.8-2.3 mm, mean 2.0 mm. Maxillary palpus black-scaled, with some white scales mesally at apex, palpomeres 3 and 4 often with some white scales laterally; length about 0.2 proboscis length. Falcate scales of vertex pale golden brown to white, usually paler medially; interocular scales concolorous with white or whitish ocular scales; forked scales cream-colored medially, golden brown to brown posterolaterally; lateral spatulate scales white. *Thorax:* Integument brown. Scutal setae golden brown to brown; scutal scales narrow, somewhat dense, golden brown; some pale yellow to white scales on margins and prescutellar area, pale scales often forming pair of faint to distinct submedian spots near middle of scutum. Scutellar scales same color as prescutellar scales. Falcate scales of antepnotum golden brown medially, paler and slightly coarser dorsally and especially ventrally, color of setae same as scales; postpronotum with narrow, golden-brown scales becoming paler posteriorly, with 4 or 5 long dark setae along posterodorsal margin. Pleural setae golden: 6 or 7 upper proepisternal, 10 or 11 prealar, 4-6 upper mesokatepisternal, 7-10 lower mesokatepisternal, 7 or 8 upper mesepimeral, and 1 lower mesepimeral. Pleura with broad white spatulate scales: small patch below upper proepisternal setae extending well mesad of setae on anterior surface, patch of narrower scales on upper portion of postspiracular area sometimes se-

parated into anterior and posterior clusters, small patch below prealar setae continuous with upper mesokatepisternal scales, large patches on upper corner and lower posterior border of mesokatepisternum, large anterior patch on mesepimeron at level of upper mesokatepisternal scales and patch before and among upper mesepimeral setae. *Wing* (Fig. 2D): Length 3.6-4.1 mm, mean 3.8 mm; length of cell R2/length of vein R2+3 2.7-3.8, mean 3.3; length of cell M1/length of cell R2 0.75-0.79, mean 0.78; scales entirely dark except for short line of white scales on posterior margin of costa at level of humeral crossvein; vein 2A usually with scales on dorsal surface, scales usually extending entire length of vein. *Halter*: Pedicel and scabellum whitish; capitellum blackish. *Legs* (mid- and hindlegs, Fig. 2I,K): Mainly black-scaled. Anterior surface of forecoxa with white scales at base and apex and black scales in middle, with many long golden-brown to brown setae among median black and distal white scales, with 3 or 4 shorter setae and few pale scales posteriorly at apex; midcoxa with midlateral row of 5 or 6 well developed golden-brown to brown setae margined anteriorly by longitudinal patch of white spatulate scales, with small patch of black scales and several short ventrally projecting setae anteriorly at apex; hindcoxa with posterolateral row of normally 8 long golden to golden-brown setae, anterolateral surface with longitudinal patch of white spatulate scales and several short ventrally projecting setae at apex. Trochanters with white scales on posterior and dorsal surfaces. Each femur with narrow pale knee spot; anterior surface of forefemur black-scaled, usually with complete or incomplete narrow ill-defined or broken anteroventral white stripe, posterior surface entirely white-scaled; midfemur like forefemur but with complete distinct or ill-defined anteroventral white stripe and black scales extending over dorsal surface toward apex; hindfemur largely white-scaled, with anterodorsal stripe of black scales beginning beyond base and widening distally, stripe abruptly expanded over anterior and posterior surfaces on distal 0.2 to form subapical band. Anterior and dorsal surfaces of foretibia black-scaled, posterior and ventral surfaces whitish-scaled; frequently with small dorsal whitish spot at apex; midtibia mainly black-scaled, whitish-scaled posteriorly, usually with narrow anterodorsal stripe of whitish scales that usually reaches small dorsal whitish spot at apex; hindtibia black-scaled with narrow anterior and posterior whitish stripes on proximal 0.8, with distinct white spot at apex. Tarsi black-scaled, tarsomeres 1 and 2 usually noticeably paler ventrally. *Abdomen*: Terga mainly black-scaled; tergum I with median posterior patch of black scales usually bordered anteriorly by some whitish scales; terga II-VII with convex basal bands and basolateral spots of white scales, bands normally 0.25-0.35 tergum length; bands usually not reaching spots on tergum II, barely touching spots on terga II-IV and joining them on terga V-VII, spots progressively larger from anterior to posterior terga; tergum VIII frequently with posterior band of black scales, but often entirely whitish-scaled. Sterna II-VII mainly with cream-colored to white scales, usually with black scales on midline and posterolateral corners; sternum VIII with dark integument and lateral patches of white scales.

MALE. Differing from the female as follows. *Head*: Proboscis usually entirely black-scaled, occasionally with some whitish scales at false joint, without ventral cluster of setae at false joint. Maxillary palpus mainly dark; midregion of palpomere 3 with narrow ventrolateral line of dingy-white scales, with few whitish scales ventromesally at apex; palpomere 4 with ventral white stripe narrowing to apex, also with indistinct or faint dorsolateral line of whitish scales; palpomere 5 with ventral spot of white scales at base. Falcate scales of vertex coarser, forked scales shorter. *Thorax*: Submedial spots of scutum extremely faint or absent. *Wing*: Length 3.1-3.6 mm, mean 3.3 mm; length of cell R2/length of vein R2+3 1.6-2.8, mean 2.1; basal line of white scales on costa ex-

tremely reduced or absent; vein 2A usually without scales. *Legs*: Anterior white stripe of midfemur sometimes less distinct. *Abdomen*: Basal white bands of terga generally broader, less convex; basolateral spots absent; terga V-VII with posterior extension of bands along lateral scale-free margins. Black scaling of sterna more extensive, pale scaling often reduced to large basolateral spots; sternum VIII (dorsal in position) with basal pale band or entirely pale-scaled. *Genitalia* (Fig. 15): Form as figured; lateral plate of phallosome generally constructed as in *vagans* and *torrentium*. Ninth tergal lobe small, with 6-16 (mode 11) setae. Gonocoxite normal; ventrolateral and mesal surfaces with usual complement of large and small setae respectively, lateral surface with 1 or 2 rows of moderately long slender setae and several rows of small setae between these and the large ventrolateral setae; subapical lobe slightly divided, proximal part prominent, bearing setae *a-c* of usual form, *b* slightly stouter than *a* and *c*; setae *d* and *e* fine, hairlike and inconspicuous, shorter than *f*, *f* a blunt rod with slightly enlarged tip; *g* foliform as usual, asymmetrical, longer than broad, apex not sharply produced; *h* slender, bent in middle. Gonostylus slightly expanded laterally near tip. Phallosome longer than broad, aedeagal sclerite shorter than lateral plate; dorsal arm of lateral plate rather long, slender, and slightly sinuous in dorsal view; lateral arm strongly developed, with conspicuous angled scooplike caudal extremity and prominent dorsal process; ventral arm spinelike, curved dorsad, and projecting slightly beyond caudal margin of lateral arm. Proctiger normal; paraproct with long, curved, distally flattened basal lateral arm, crown mostly of small spinelike spicules but with some inconspicuous lateral blades. Cercal sclerite and tergum X unmodified; 1-3 cercal setae, usually 2.

Pupa (Fig. 15). Not associated with adults from southwestern Asia, specimens examined primarily from South Africa; character and placement of setae as figured, range and modal number of branches in Table 7; not immediately distinguishable from *pipiens* and related species, differing chiefly in the number of branches of setae 6-III and 3-VII, resembling *theileri*, *perexiguus*, *antennatus*, *simpsoni*, and *sinaiticus* in this respect. *Cephalothorax*: Seta 5-CT rather short, about same length and thickness as 4-CT; 6-CT with 3-5 branches occurring in nearly equal frequencies; 9-CT double or triple; 11-CT single or double; 12-CT triple. *Trumpet*: Generally longer than in *pipiens*, index 5.6-7.3, mean 6.4; pinna shorter than tracheoid area, usually about 0.25-0.30 trumpet length; tracheoid area normally about 0.35-0.40 trumpet length. *Abdomen*: Length 2.7-3.2 mm, mean 3.0 mm; seta 6-III normally with 3 or 4 branches, rarely double, 6-IV-VI most often with 4 branches (3-5); 5-IV very nearly same length and thickness as 5-V, VI, with 5 or 6 branches, 5-V with 3 or 4 branches, 5-VI double or triple; 3-VII most often with 4 branches (3-5). *Paddle*: Length 0.82-0.94 mm, mean 0.88 mm; width 0.56-0.71 mm, mean 0.63 mm; index 1.3-1.5, mean 1.4; outer margin with tiny serrations on proximal 0.5.

Larva (Fig. 16). Not associated with adults from southwestern Asia, specimens examined include topotypic material; form and positions of setae as figured, see Table 27 for range and modal number of branches; very closely resembling *antennatus*, but usually distinguished by the combination of shorter seta 1-C, siphon with 2 lateral pairs of seta 1-S, seta 1-M usually single, and abdomen without obvious 2-banded appearance in life. *Head*: Length 0.69-0.84 mm, mean 0.76 mm; width 1.02-1.24 mm, mean 1.15 mm; lightly tanned, darker behind eyes. Dorsomentum usually with 7 teeth (6-8) on either side of median tooth. Seta 1-C normally shorter than in *antennatus*, tapered, not heavily tanned; 2-C occasionally present; 5,6,11-C as in *antennatus* but 5-C occasionally with 4 branches. *Antenna*: Length 0.50-0.64 mm, mean 0.57 mm; lightly tanned, distal part slightly darker, dark on mesal surface at base. Seta 1-A with about 27 branches (17-30). *Thorax*: Integument hyaline; with rows of vesicles on ventral

surface. Seta 7-P almost always triple, seldom double; 8-P normally double, rarely triple. Seta 1-M single or double, more often single, not much longer than 2-M. Seta 2-T most often triple (2-4). *Abdomen*: Ventral surface with rows of vesicles; segments III and V without conspicuous pigmentation. Chaetotaxy resembles that of *antennatus* in nearly all respects; seta 6-VI usually single, occasionally double. *Segment VIII*: Comb with 32-55 scales, mean 43. *Siphon*: More lightly tanned and generally slightly shorter than in *antennatus*; index 4.93-7.15, mean 5.72. Pecten with 8-15 spines, mode 11; larger spines with 3 or 4 basal denticles. Seta 1-S in 5 or 6 pairs, 1a-S (when present) usually borne within pecten, 2 pairs (1d, 1e) borne laterally; length distinctly less than diameter of siphon, usually 0.5 or less diameter at point of attachment; branching variable, distal elements usually with more branches than proximal elements (see table). *Segment X*: Saddle length 0.37-0.42 mm, mean 0.40 mm; siphon/saddle index 3.56-4.30, mean 3.82. Seta 1-X most often with 3 or 4 branches, occasionally double; 2-X usually double, sometimes triple.

Systematics. *Culex univittatus* is a member of a very interesting species aggregate. A thorough comparative study of this group has not been made yet but it appears from a superficial examination of available material from Africa that three nominal taxa and a possible fourth species are involved. The group includes *univittatus*, which appears to be restricted to the temperate highlands of southern and eastern Africa and the southwestern corner of the Arabian Peninsula; *neavei* Theobald, 1906, which seems to occur throughout the subtropical and tropical lowlands south of the Sahara; *perexiguus*, which inhabits the arid areas of northern and eastern Africa and southwestern Asia; and another species which occurs in the evergreen rain forest of the Congo Basin. Jupp (1972) identified specimens of *univittatus* from Benin, Niger, and Upper Volta, but I do not believe that this species occurs in western Africa. These records probably refer to *neavei* or an undescribed species.

The members of the *univittatus* aggregate are remarkably similar in all life stages. The three nominal forms are characterized by slight and variable differences in adult ornamentation and features of the male genitalia. These characters are contrasted for *univittatus*, *perexiguus*, and *neavei* in Table 41. Some of these were noted previously (Jupp, 1970, 1971, 1972) while others are noted here for the first time. No definite differences have been found in the immatures, but the larva of *univittatus*, based on the examination of topotypic material, appears to be separable from *perexiguus* and *neavei* by the development of seta 1-S. It is hoped that this information will provide a starting point for a critical objective study of the group throughout its range. Few specimens are currently available from most areas, and there are very few individual rearings from anywhere other than Egypt. A comprehensive study of the group must include extensive sampling throughout Africa and southwestern Asia.

The occurrence of *univittatus* in southwestern Asia is based on the examination of a male and a female from the Yemen Arab Republic and the P.D.R. Yemen, respectively. These are undoubtedly the specimens which Mattingly and Knight (1956) recorded from the Yemen Arab Republic, the male erroneously. These specimens agree well with the concept of *univittatus* presented here.

A very striking feature of *univittatus* is the presence of a line of scales marking the position of vein 2A. To my knowledge, this character is unique among mosquitoes and appears to be a primitive feature in the family Culicidae. *Culex univittatus* appears to be somewhat of a relict species.

Bionomics. Very little is known about the biology of *univittatus*, partly because it has been confused with *neavei* in the past. The species seems to be fairly abundant in more temperate areas of the Afrotropical Region. Larvae are found in fresh water

ground pools, marshes, ditches, swamp margins, stream margins, and cattle hoofprints under some degree of shade. Females feed primarily on birds (Anderson, 1967), but will enter houses and bite humans (Jupp and McIntosh, 1967). Sindbis, West Nile, and Wesselsbron viruses have been isolated from wild-caught specimens in South Africa (Weinbren et al., 1956; McIntosh et al., 1967; Worth and De Meillon, 1960; respectively). McIntosh et al. (1967) regard *univittatus* as the primary feral vector of both Sindbis and West Nile infections in that country.

Distribution. *Culex univittatus* is generally distributed in the temperate highlands of the Afrotropical Region.

Material examined. 306 specimens. Only 3 specimens (1 F, 1 M, and 1 M genitalia) were examined from southwestern Asia — P.D.R. YEMEN: (Mukaira); YEMEN ARAB REPUBLIC: (Usaifira). A total of 303 specimens (110 females, 76 males, 41 male genitalia, 6 pupal exuviae, 3 larval exuviae, and 67 fourth-instar larvae) were examined from ANGOLA, ETHIOPIA, KENYA, MADAGASCAR (the type series of *montforti*), SOUTH AFRICA (the holotype female of *ataeniatus*), TANZANIA, ZAIRE, and ZIMBABWE (including the type series of *univittatus* and the holotype female of *simplex*).

A total of 253 specimens (111 females, 52 males, 44 male genitalia, 14 pupal exuviae, 18 larval exuviae, and 14 fourth-instar larvae) of *Culex neavei* from the following countries were examined and compared with *univittatus* and *perexiguus* during this study: BENIN, ETHIOPIA, GAMBIA, GHANA, KENYA, MALAWI, MOZAMBIQUE, NIGER, NIGERIA, SOUTH AFRICA, SUDAN (including the type series of *neavei*), TANZANIA, UGANDA, UPPER VOLTA, ZAIRE, and uncertain locations.

Culex (Culex) perexiguus Theobald

perexiguus Theobald, 1903a: 199. +Lectotype male: Sidon, Palestine [Lebanon]; designated by White, 1975: 318 (BM).

Culex decens Theobald of Storey, 1918(1919): 100 (Egypt, A, L keys, A); ? Abul-hab, 1968: 249 (Iraq, L key).

Culex (Culex) decens Theobald of ? Abdel-Malek, 1960: 113-118 (Syria, L bionomics, distr.); Ibrahim et al., 1983: 91 (Iraq, L key, L*).

Culex pallidocephalus Theobald of Gough, 1914: 135 (Egypt, coll. sites).

Culex perexiguus Theobald of Theobald, 1905a: 28 (Israel, Jordan); Edwards, 1922: 278 (Oriental Region, A key); Buxton, 1923: 316 (Israel, Jordan, coll. rec., A, L bionomics); Theodor, 1923: 344 (Israel, Jordan, P*, key); Barraud, 1924b: 1263 (India, A key, M*, F, distr.); Barraud, 1924c: 431 (India, L*); Kirkpatrick, 1924(1925): 368, 372 (Egypt, A, L keys).

Culex (Culex) perexiguus Theobald of Edwards, 1921: 342 (Egypt, Israel, Jordan, Oman, A, L keys, L*, tax., distr.); Séguy, 1924: 38, 190 (Lebanon, Egypt, A, L keys, L*, tax., distr., syn.); Kirkpatrick, 1925: 125, 191 (Egypt, A, P, L keys, M*, F, P*, L*, bionomics, distr.); Stackelberg, 1927: 163 (Middle East, A key, A, M gen.*, distr.); Senevet and Andarelli, 1954: 63 (Egypt, A key, M, F); White, 1975: 318, 322 (Africa, SW Asia, A key); Harbach, 1985a: 86, 93, 104 (SW Asia, Egypt, distr., A, L keys).

Culex univittatus Theobald of Barraud, 1921: 394 (Israel, Jordan, Egypt, L habitat, distr.); Parr, 1943: 247-250 (Syria, Lebanon, A, P, L keys, bionomics); Theodor, 1952: 113 (Middle East, zoogeogr.); Gad, 1956: 135 (Egypt, distr., bionomic note); Senevet et al., 1957a: 86 (North Africa, L*); Nielsen and Nielsen, 1958:

311 (Iraq, swarming beh.); Margalit and Tahori, 1970a: 142 (Israel, bionomics); Margalit et al., 1971: 323 (Israel, bionomics); Margalit et al., 1973: 32 (Israel, coll. rec.); El-Said and Kenawy, 1983a (Egypt, distr.); Kitron and Pener, 1986 (Israel, L bionomics).

Culex univittatus form *perexiguus* Theobald of Mattingly, 1954: 56 (eastern Mediterranean form, zoogeogr.).

Culex (*Culex*) *univittatus* Theobald of Edwards, 1926: 138 (Egypt, Israel, Jordan, Oman, A, L keys, syn., A, L*, distr.); Martini, 1931: 389 (Turkey, Oman, A, L keys, M*, F, L*, distr.); Barraud, 1934: 418 (India, A, L keys, M*, F, L*, L habitat, distr.); Lewis, 1943b: 72 (in part; bionomic note); Senevet, 1947a: 126 (Turkey, Egypt, L*, distr., L habitat, bionomics, L key); Abbott, 1948: 45 (Sudan, L); Senevet, 1949: 64 (North Africa, M gen.*, key); Monchadskii, 1951: 279 (Middle East, L*, key, bionomics, distr., syn.); Hopkins, 1952: 291 (in part; Afrotropical Region, L*, key, bionomics); Abdel-Malek, 1956: 101 (Sinai, L bionomics, L key); Lewis, 1956, 708 (at least in part; Sudan, coll. sites); Mattingly and Knight, 1956: 104, 122 (in part; Oman, A, L keys); Senevet et al., 1957b: 92 (North Africa, L); Parrish, 1959: 266 (Turkey, distr.); Abdel-Malek, 1960: 113-125 (Syria, coll. sites, L bionomics); DuBose and Curtin, 1965: 252, 254 (Mediterranean area, A, L keys); Abul-hab, 1968: 246 (Iraq, distr., L key); Lotfi, 1970: 402 (Iran, coll. rec.); Margalit and Tahori, 1970b: 153 (Israel); Aslamkhan, 1971: 155 (Pakistan); Jupp, 1972: 105-113 (short-spined form, M gen.*, F, distr.); Ward, 1972: 96 (Afghanistan); Lotfi, 1973: 207 (Iran, coll. sites); Gutsevich et al., 1974: 385 (Middle East, A, L keys, A, M gen.*, L*, L bionomics, med. imp.); Margalit and Tahori, 1974: 88 (Israel, coll. rec.); Lotfi, 1976: 73, 76, 82 (L key, ecol. note, L*); Sirivanakarn, 1976: 48 (Oriental Region, A, P, L keys, M*, F*, P, L*, tax., distr., bionomics); El-Said and Kenawy, 1983b (Egypt, coll. rec.); Danilov, 1985a: 71 (Afghanistan, F key); Danilov, 1985b: 55 (Afghanistan, L key).

Culex (*Culex*) *univittatus* form *perexiguus* Theobald of Lewis, 1956: 708 (Sudan, distr.); Senevet and Andarelli, 1959: 212 (North Africa, Mediterranean basin, A, L keys, syn., A distr., bionomics).

Culex (*Culex*) *univittatus* var. *perexiguus* Theobald of Mattingly and Knight, 1956: 104, 135 (Oman, distr., zoogeogr.); Ovazza et al., 1956: 171 (Ethiopia, M gen.*, coll. sites); Mekuria et al., 1978: 80 (Ethiopia, distr.).

Adult. This common and widespread species closely resembles *univittatus* in almost all respects, but the midfemur lacks a complete anterior pale stripe, vein 2A is normally without scales, and the ventral arm of the male phallosome is short.

FEMALE. *Head:* Antenna dark, length 1.4-1.6 mm; pedicel with patch of pale scales on dorsomesal surface; flagellomere 1 with few pale scales on mesal surface near base. Proboscis dark-scaled, pale-scaled ventrally except at base, weakly pale on distal 0.25; length 1.7-1.8 mm. Maxillary palpus dark-scaled; palpomere 4 with pale scales dorsomesally at apex, palpomeres 3 and 4 often with some lateral pale scales; length 0.3-0.4 mm, about 0.2 proboscis length. Falcate scales of vertex narrow, pale ochreous to whitish, those of ocular line off-white and concolorous with interocular scales; forked scales pale yellow medially, becoming brownish laterally; lateral spatulate scales white. *Thorax:* Integument brown. Scutal scales narrow, somewhat dense, golden brown; scales very pale yellow or whitish along extreme margins and around margin of prescutellar area; pair of submedial, very faint to distinct pale spots on middle of scutum; occasionally with trace of median anterior pale stripe. Falcate scales of antepnotum pale yellow, paler ventrally; postpronotum with golden-brown falcate scales. Pleural

setae golden: 6-8 proepisternal, 12-16 prealar, 4-6 upper mesokatepisternal, 7-11 lower mesokatepisternal, 9 or 10 upper mesepimeral, and 1 (rarely 2) lower mesepimeral. Pleura with white spatulate scales as follows: small patch below upper proepisternal setae extending mesad onto anterior surface above level of base of coxa; postspiracular area with patch on dorsal 0.5; posterior anepisternum with small patch below prealar knob, usually more or less contiguous with upper katepisternal scales; katepisternum with patches on upper corner and posterior border above coxa, extensive but well separated; anterior and upper patches on anepimeron. *Wing*: Length 3.0-3.5 mm, mean 3.2 mm; length of cell R2 2.2-2.8 length of vein R2+3, mean 2.4; length of cell M1 0.7-0.8 length of cell R2; dark-scaled with short line of dorsal pale scales on posterior margin of costa at humeral crossvein; rarely with few pale scales at extreme base of R; vein 2A occasionally with few scales distally, rarely with scales on entire length. *Halter*: Pedicel and scabellum pale yellow; capitellum brown. *Legs* (hindleg, Fig. 2K): Anterior surface of forecoxa with white spatulate scales at base and mixed pale and dark scales distally, dark scales mostly in middle; mid- and hindcoxae with vertical patch of white spatulate scales on anterior side of lateral midline. Each femur with narrow pale knee spot; forefemur dark-scaled anteriorly, pale-scaled posteriorly, sometimes with trace of anteroventral pale stripe; midfemur dark-scaled anteriorly, dark scales progressively expanding over dorsal surface toward apex, with or without narrow incomplete anteroventral longitudinal pale stripe, stripe faint, broken or distinct when present; hindfemur pale-scaled with dorsal dark stripe usually beginning about 0.3 from base and broadening apically. Anterior and dorsal surfaces of foretibia dark-scaled, posterior and ventral surfaces pale-scaled; midtibia dark-scaled with anterodorsal and posteroventral pale stripes; hindtibia dark-scaled dorsally, with broad anterior and ventral pale stripes on proximal 0.8, stripes joined ventrally for at least part of their length distally, separated on proximal 0.5 or less by narrow, often faint, distally diminished, dark stripe, with distinct apical pale spot. Tarsi dark-scaled dorsally, pale-scaled ventrally; with very faint indication of paler scales at apices of tarsomeres 1-4. *Abdomen*: Tergum I with median posterior scale patch usually comprised of pale and dark scales; terga II-VIII with slightly convex basal white bands, bands 0.20-0.35 length of terga and continuous with elongate basolateral patches of same color. Sterna usually completely pale-scaled, occasionally with dark scales on posterolateral corners, less frequently also with median patch of dark scales.

MALE. Differing from female as follows. *Head*: Proboscis essentially lacking midventral pale scales; generally slightly longer, length 1.8-2.0 mm, mean 1.9 mm. Maxillary palpus dark brown-scaled, length 2.4-2.7 mm, mean 2.6 mm; palpomere 2 with some lateral pale scales; lateral surface of palpomere 3 with pale scales beginning above base and few pale scales ventromesally at apex; palpomere 4 with narrow line of pale scales tapering distally on ventral surface and dorsolateral line of pale scales ending just short of apex; palpomere 5 with spot of white scales ventrally at base and somewhat faint dorsolateral line of pale scales tapering distally to near apex. Falcate scales of vertex very nearly white; forked scales paler than in female but still brownish laterally; lateral spatulate scales broader dorsally than ventrally and posteriorly. *Thorax*: Pair of pale spots extremely faint or absent on middle of scutum. Upper proepisternal scales more extensive, usually well extended mesally on anterior surface. *Wing*: Length of cell R2 shorter, length of cell R2/length of vein R2+3 variable, 1.5-2.1, mean 1.8. *Legs*: Midfemur usually without anterior pale stripe. *Abdomen*: Terga as in female except VI and VII only with middle area dark-scaled, borders with pale scales. Sterna usually with median steak and posterolateral spots of dark scales. *Genitalia* (Fig. 17): Almost exactly as in *univittatus*, the only obvious distinctions being the following: seta *g* of subapical

lobe of gonocoxite broader; ventral arm of lateral plate of phallosome shorter, not projecting beyond caudal margin of lateral arm.

Pupa (Fig. 17). Character and placement of setae as figured, range and modal number of branches in Table 8; no specific differences from *univittatus* are apparent, setae 6,12-CT and 6-III-VI tend to have fewer branches. *Cephalothorax*: Seta 6-CT usually triple (2-4); 12-CT most often double (2-4). *Trumpet*: As in *univittatus*, index 5.4-7.5, mean 6.5. *Abdomen*: Length 2.7-3.0 mm, mean 2.8 mm; setae 1-III-VI and 5-IV-VI tend to be rather shorter than in *univittatus*; 6-III usually triple, seldom double or with 4 branches, 6-IV-VI most often triple (3-5). *Paddle*: Length 0.84-0.94 mm, mean 0.89 mm; generally not as broad as in *univittatus*, width 0.53-0.61 mm, mean 0.57 mm; index 1.5-1.7, mean 1.6.

Larva (Fig. 18). Form and positions of setae as figured, range and modal number of branches in Table 28; characters almost the same as in *univittatus*, the only apparent distinction being the development of seta 1-S; the siphon/saddle index is generally larger. *Head*: Length 0.71-0.86 mm, mean 0.78 mm; width 1.12-1.38 mm, mean 1.28 mm. Dorsomentum most often with 7 teeth (6-9) on either side of median tooth. *Antenna*: Length 0.54-0.64 mm, mean 0.60 mm. Seta 1-A with about 22 branches (19-27). *Thorax*: Seta 7-P normally triple, seldom with 4 branches. Seta 2-T usually double, sometimes triple. *Abdomen*: Setae 3-I-VII and 7-VI tend to have fewer branches than in *univittatus*. *Segment VIII*: Comb with 37-62 scales, mean 51. *Siphon*: Generally slightly longer than in *univittatus* (see); index 5.45-7.87, mean 6.77. Pecten with 9-15 spines, mode 13. Seta 1-S normally in 5 pairs, sometimes only 4.5 pairs present, all normally borne beyond pecten; length about as long as diameter of siphon at point of attachment; always with fewer branches than in *univittatus*, each element usually double or triple (*cf.* tables). *Segment X*: Saddle length 0.35-0.46 mm, mean 0.41 mm; siphon/saddle index 4.20-4.87, mean 4.44. Seta 1-X double or triple in nearly equal frequencies.

Systematics. The recognition of *perexiguus* as a species distinct from *univittatus* is somewhat provisional. The taxonomic status of these forms cannot be settled unequivocally without a comprehensive study of individually reared material from sympatric populations. An important analogy exists between these forms and *pipiens*. The distribution of these forms coincides exactly with the distribution of *pipiens* in southwestern Asia and Africa, yet *pipiens* is considered to be a single plastic species while *univittatus* and *perexiguus* are regarded as separate species. The reason for this is that *univittatus* and *perexiguus* exhibit slight anatomical differences (see Table 41), whereas none are apparent in *pipiens*. For the present I am treating *perexiguus* as a distinct species primarily because these differences, although variable, were observed in a limited number of specimens from Ethiopia where the forms appear to be sympatric. However, these forms seem to occur at different altitudes, and the observed differences may be due in large part to environmental influences.

Bionomics. *Culex perexiguus* is a common mosquito which is particularly abundant during the summer and autumn months. The immature stages are found in a variety of standing water habitats including swamps, springs, stream pools, ponds, and wells. Breeding occurs in clean to moderately polluted water which usually contains quantities of emergent vegetation. This species tolerates some degree of salinity and occasionally utilizes artificial containers. It generally breeds away from dwellings, but has the ability to adapt to breeding places modified by man. It is frequently found in association with *pipiens*, *antennatus*, and *Aedes (Ochlerotatus) caspius* (Pallas).

Although *perexiguus* probably feeds mainly on birds, it apparently occasionally enters houses and bites man (Buxton, 1923; Kirkpatrick, 1925). West Nile virus has

been isolated from this species in Israel (Nir et al., 1968; Samina et al., 1986) and Egypt (Taylor et al., 1953; Taylor et al., 1956). Isolations of Sindbis virus have been made in Israel (Samina et al., 1986), Egypt (Taylor et al., 1955), and Saudi Arabia (Wills et al., 1985). Experimental transmission of Sindbis virus has been demonstrated for Egyptian populations (Taylor et al., 1955).

Distribution. *Culex perexiguus* is widely distributed in northern Africa and southwestern Asia, and extends eastward into India.

Material examined. 2,696 specimens. A total of 2,546 specimens (689 females, 445 males, 65 male genitalia, 889 pupal exuviae, 429 larval exuviae, and 29 fourth-instar larvae) were examined from southwestern Asia — AFGHANISTAN: (Garwargin); EGYPT: *Aswan* (Aswan, El 'Aqaba el Saghira, Ezbet el Silsila, Khour Abu Subeira, Kom Ombo, Nag el Higab, Nag el Idwa el Bahari, Nag el Kagug, Nag el Ritag el Qibli, Nag el Shalabab, Nag' Tingar, Sahara City), *Asyut* (Beni Shiqeir), *Beni Suef* (Biba), *Eastern Deserts* (Bir el Maskhara, Wadi Digla, Farouk Field), *El Buhayra* (Wadi Natrun), *El Fayyum* (Abhit el Hagar, Birket Qarum, Sanhur Bahariya, Sinero el Bahria), *El Girgha* (El Birba), *El Giza* (Abu Ragwan el Bahari, Abu Rauwash, El Badrshein, Ezbet Bosna Sharawy, Harania, Kafr el Ghataty, Koneissa, Nazlet el Ashtar, Saqqara, Talbia), *El Isma'iliya* (Abu Khalifa, Isma'iliya), *El Qahira* (Abbassia, Kirdasa, Ezbet Said), *El Qalyubiya* (Ga'afara, Kaha, Khanka), *El Sharqiya* (Inshas el Raml), *Port Said* (Port Said), *Qena* (Nag' Hammadi); IRAN: (Andimeshk, Behbahan, Bisotun, Ghosse, Kermanshah, Khorramabad, Natchi Bahrán, Shirin, Teheran); IRAQ: (Daurah); ISRAEL: (Akka, Baniass, Beer Sheva, Beisan, Deir el Belah, Ein el Howl, Eliot, Galilee, Gaza, Genin, Hadera, Inlerl, Jerisheh, Khirbet Hadrah, Kishon River, Lake Huleh, Latron, Lhallal, Ludd, Nahala, Nahr es Zerga, Nahr Rubin, Shivta, Sidrat el Mallaha, Tel Aviv, Wassat, Zichron); JORDAN: (Amman, Tafila, Taflah); LEBANON: (the lectotype male and paralectotype female); OMAN: (Itelba, Se' Harr); PAKISTAN: (Peshawar); SAUDI ARABIA: (Al Hasa Oasis, Al Khobar, Al Qatif, Riyadh). An additional 150 specimens (46 females, 29 males, 27 male genitalia, 6 pupal exuviae, 17 larval exuviae, and 25 fourth-instar larvae) were examined from ALGERIA, CHAD, DJIBOUTI, ETHIOPIA, MOROCCO, SENEGAL, SUDAN, TUNISIA, UPPER VOLTA, and unknown localities.

***Culex (Culex) theileri* Theobald**

theileri Theobald, 1903a: 187. +Lectotype male: Pretoria, Transvaal, [South Africa] (BM), designated by Sirivanakarn, 1976: 45.

creticus Theobald, 1903a: 189. +Holotype female: Crete, Greece (BM).

Synonymy with *theileri* by Edwards, 1932a: 210.

pettigrewii Theobald, 1910a: 15. +Holotype female: Ukhrul, Manipur, 6400 ft., [Assam], India (BM). Synonymy with *theileri* by Edwards, 1911: 262.

onderstepoortensis Theobald, 1911: 265. +Holotype female: Onderstepoort, Transvaal, [South Africa] (BM). Synonymy with *theileri* by Edwards, 1932a: 210.

annulata Theobald, 1913: 321(*theileri* var.). Type specimens (female): Onderstepoort, Transvaal, [South Africa] (? BM, see Harbach, 1983: 103, 104). Synonymy with *theileri* by Edwards, 1932a: 210.

alpha Séguy, 1924: 41. Lectotype larva, hereby designated, larva illustrated by Séguy (1924: Pl. VII, Fig. 34), specimen non-extant (?) (see Harbach, 1983: 99). NEW SYNONYMY.

Culex theileri Theobald of Gough, 1914: 135 (Egypt, coll. site); Storey, 1918(1919): 98 (Egypt, A, L keys, bionomics); Barraud, 1924b: 1266 (India, A key, syn., M*, F, distr.); Barraud, 1924c: 429 (India, L*); Scott, 1927: 88 (Ethiopia, coll. rec.); Salem, 1938: 27 (Sinai); Salem, 1940: 15 (Egypt, A, M gen.*); Parr, 1943: 246-251 (? Syria, Lebanon, A, P, L keys, bionomics); Senevet, 1947: 212 (North Africa, L key); Theodor, 1952: 113 (Middle East, zoogeogr.); Dow, 1953: 688 (Iran, coll. rec., L bionomics); Mattingly, 1954: 58 (Africa, Asia, zoogeogr.); Gad, 1956: 135 (Egypt, distr., bionomic note); Senevet et al., 1957a: 85-86 (North Africa, L*); Nielsen and Nielsen, 1958: 312 (Iraq, swarming beh.); Derwesh, 1965: 44 (Iraq); Margalit and Tahori, 1970a: 142 (Israel, bionomic note); Margalit et al., 1971: 323 (Israel, bionomics); Gad and Salit, 1972: 581 (Egypt, coll. site); Margalit and Tahori, 1973: 92, 93 (Sinai, distr., L assoc.); Margalit et al., 1973: 32 (Israel, coll. rec., L assoc.); Büttiker, 1981: 476 (Saudi Arabia, coll. site); El-Said and Kenawy, 1983a (Egypt, distr.); Zaini et al., 1983: 117 (Iraq, bionomic note); Kitron and Pener, 1986 (Israel, L bionomics).

Culex (Culex) theileri Theobald of Edwards, 1926: 133 (Mediterranean Region, A, L keys, A, L*, syn., distr.); Martini, 1931: 384 (Egypt, Israel, Jordan, Syria, Turkey, A, L keys, M*, F, L*, distr.); Barraud, 1934: 414 (India, A, L keys, M*, F, L*, syn., L habitat, distr.); Edwards, 1941: 305, 419, 482 (Afrotropical Region, A key, M*, F*, P, syn., distr.); Lewis, 1943a: 281 (Eritrea, coll. rec., L bionomic note); Lewis, 1945: 15 (Sudan, A, distr.); Senevet, 1947a: 124 (Egypt, L*, distr., L bionomics, L key); Senevet, 1949: 57, 64 (North Africa, M gen.*, key); Monchadskii, 1951: 275 (Middle East, L*, key, L assoc., distr.); Hopkins, 1952: 289 (Afrotropical Region, L*, key, bionomics); Knight, 1953a: 232 (Yemen Arab Republic, coll. rec.); Senevet and Andarelli, 1954: 60 (North Africa, A key, M, F); Khattat, 1955: 165 (Iraq, syn., L bionomics, distr., L*); Abdel-Malek, 1956: 101 (Sinai, L bionomics, distr.); Lewis, 1956: 708-718 (Sudan, Egypt, Eritrea, L, coll. sites, distr.); Mattingly and Knight, 1956: 106-129 (P.D.R. Yemen, Yemen Arab Republic, L*, A, L keys, distr., zoogeogr.); Ovazza et al., 1956: 171 (Ethiopia, L*, coll. sites); Parrish, 1959: 266 (Turkey, distr.); Senevet and Andarelli, 1959: 195 (North Africa, Mediterranean basin, A, P, L keys, syn., M*, F*, P*, L*, distr., bionomics); Abdel-Malek, 1960: 113-123 (Syria, coll. sites, L bionomics, distr.); Khalaf, 1962: 54 (Iraq, A, L, L habitat); Derwesh, 1965: 44 (Iraq); DuBose and Curtin, 1965: 352, 354 (Mediterranean area, A, L keys); Abul-hab, 1966: 281 (Iraq, distr., L bionomics); Abul-hab, 1968: 245 (Iraq, L habitat, distr., L key); Lotfi, 1970: 402 (Iran, coll. rec.); Margalit and Tahori, 1970b: 153 (Israel, coll. sites); Aslamkhan, 1971: 155 (Pakistan); Ward, 1972: 96 (Afghanistan); Lotfi, 1973: 206 (Iran, coll. sites); Gutsevich et al., 1974: 388 (Asia, A, L keys, M*, F, L*, distr., bionomics); Margalit and Tahori, 1974: 87 (Israel, coll. rec.); Lotfi, 1976: 72, 74, 80 (Iran, L key, ecol. note, L*); Sirivanakarn, 1976: 43 (Oriental Region, A, P, L keys, M*, F*, P, L*, tax., distr., bionomics); El-Said and Kenawy, 1983b (Egypt, coll. rec.); Ibrahim et al., 1983: 91 (Iraq, L*, key); Danilov, 1985a: 71 (Afghanistan, F key); Danilov, 1985b: 55 (Afghanistan, L key); Harbach, 1985a: 86, 92, 106 (SW Asia, Egypt, distr., A, L keys).

Culex tipuliformis Theobald of Edwards, 1912b: 31 (Africa, A key); Barraud, 1920: 324 (Iraq, bionomic note); Barraud, 1921: 394 (Israel, Jordan, Egypt, distr., L assoc.); Edwards, 1922: 278 (Oriental Region, A key); Buxton, 1923: 317 (Israel, Jordan, coll. rec., bionomic note); Theodor, 1923: 344 (Israel, Jordan, P*); Kirkpatrick, 1924(1925): 367, 371 (Egypt, A, L keys).

Culex (Culex) tipuliformis Theobald of Edwards, 1921: 339 (Mediterranean Region, A, L

keys, L*, tax., distr.); Séguy, 1924: 40, 192 (Egypt, Iran, Turkey, A, L keys, L*, tax., distr., syn.); Kirkpatrick, 1925: 115, 188 (Egypt, A, P, L keys, syn., M*, F, P*, L*, distr., bionomics); Stackelberg, 1927: 159 (Middle East, M, F keys, A, M gen.*, distr.).

Adult. A distinct species with postspiracular and prealar scales and anterior white stripes on all tibiae and the fore- and midfemora. Easily distinguished from all other *Culex* species of southwestern Asia and Egypt, except perhaps *univittatus*, *perexiguus*, and *vagans*. *Culex univittatus* and *perexiguus* are normally without an anterior white stripe on the foretibia and *vagans* is without postspiracular and prealar scales.

FEMALE. Scaling of proboscis, maxillary palpus, legs, and abdominal terga predominantly brownish black, legs blacker. *Head:* Antenna with some nearly white scales on mesal surface of pedicel and flagellomere 1; length 1.6-2.0 mm. Proboscis length 2.2-2.7 mm, mean 2.5 mm; dorsal surface largely black-scaled but often with scattered pale scales, particularly in middle; ventral surface entirely with cream-colored scales except at base. Maxillary palpus about 0.2 of proboscis length, with variable amount of pale scaling; palpomere 4, and usually 3, with distinct dorsomesal patch of white scales at apex, sometimes entire dorsomesal surface of both white-scaled; scattered pale scales laterally, sometimes lateral surface entirely white-scaled. Falcate scales of vertex whitish to light brown, usually largely pale yellow posteriorly, narrower and darker anteriorly and laterally, narrowly white along margin of eye; forked scales pale yellow medially, brown to blackish laterally; lateral spatulate scales white, narrow. *Thorax* (Fig. 2B): Scutal integument dark brown; scales dense, rather fine to moderately coarse, yellowish brown to golden brown, whitish or pale yellow on extreme anterior and lateral margins and prescutellar area. Lobes of scutellum with scales same as prescutellar scales. Falcate scales of anteprenotum yellow, becoming pale yellow to white posteriorly; falcate scales on anterior 0.67 of postpronotum fine, golden yellow, larger and pale yellow to white on posterior 0.33. Pleural integument light to moderate brown, faded posteriorly, frosted with dense covering of aculeae, with patches of white narrow spatulate scales on upper area of proepisternum, postspiracular area near mesothoracic spiracle, lower part of prealar area, upper and lower areas of mesokatepisternum, and anterior and upper areas of mesepimeron, prealar patch continuous with upper mesokatepisternal patch, latter usually continuous with lower mesokatepisternal patch, anterior and upper mesepimeral patches often continuous; pleural setae golden: 10-16 upper proepisternal, 7-14 prealar, 4-7 upper mesokatepisternal, 7-13 lower mesokatepisternal, 5-16 upper mesepimeral, and 1 lower mesepimeral. *Wing:* Length 3.9-4.8 mm, mean 4.4 mm; length of cell R2 2.8-3.5 length of vein R2+3, mean 3.3; length of cell M2 about 0.8 length of cell R2; scales almost entirely black or nearly black, pale scales on posterior side of costa, distal 0.67 of subcosta, anterior side of distal 0.5 of R, and anterior side and approximately distal 0.5 of posterior side of R1. *Halter:* Same color as thoracic integument, with pale yellow to white scales on capitellum. *Legs* (midleg, Fig. 2G): Anterior surface of forecoxa largely white-scaled, with black scales in middle; midcoxa with small patch of white scales at base, these more or less distinctly separated anteriorly from longitudinal patch of concolorous scales on anterior side of lateral midline; hindcoxa with patch of white spatulate scales on anterior side of lateral midline. All femora with narrow knee spots of white scales; posterior surface of fore- and midfemora white-scaled, anterior surface dark-scaled with narrow longitudinal stripe of white scales, white stripe of forefemur placed anteroventrally and sometimes more or less broken up into spots, white stripe of midfemur borne medially with dark scales not reaching base and anterodorsal line of dark scales progressively expanding onto dorsal

surface toward apex; hindfemur white-scaled with dorsal and anteroventral stripes of dark scales, dorsal stripe beginning beyond base and gradually widening distally, anteroventral stripe on approximately distal 0.5. Anterodorsal surface of foretibia dark-scaled with complete longitudinal stripe of white scales, posteroventral surface white-scaled; anterior and posterior surfaces of mid- and hindfemora with complete stripe of white scales, narrowly dark-scaled on dorsal and ventral surfaces. Tarsomere 1 of all tarsi more or less distinctly pale-scaled with anterodorsal longitudinal stripe of dark scales; other tarsomeres more or less completely dark-scaled, scales appearing opalescent under light of certain angles. *Abdomen*: Tergum I with median posterior patch of pale scales; tergum II with median longitudinal patch of creamy-white scales that is broadest basally and may extend entire length of tergum; terga III-VII with more or less triangular basal patches of creamy-white scales, lateral patches of white scales and usually with narrow band of pale scales on posterior border, triangular patches broader, produced less in middle and often continuous with lateral patches on posterior terga, sometimes posterior angle of triangular patches extends to posterior margin or this area with pair of submedial spots of pale scales; tergum VIII largely or entirely pale-scaled. Sterna usually with scattered dark scales but sometimes with all whitish or yellowish scales or a mixture of both; dark scales sometimes fairly numerous and arranged in more or less distinct submedial longitudinal stripes and posterolateral spots that are often joined posteriorly.

MALE. Differing from female as follows. *Head*: Maxillary palpus approximately 1.25 length of proboscis; integument dark brown; palpomeres 1 and 2 with scattered pale scales ventrally; palpomere 3 with extensive patch of white scales on dorsolateral margin of distal 0.67 and small mesal patch near apex, setose ventrally; dorsal and ventral surfaces of palpomere 4 each with line of white scales; palpomere 5 white-scaled dorsally, with small patches of white scales ventrally at base and apex; palpomeres 4 and 5 densely setose, each with lateral rows of dark setae. Dorsal falcate scales of vertex more numerous; color more uniformly pale yellow. *Thorax*: Scutal scales finer; with 22-27 upper proepisternal setae. *Wing*: Length of cell R2 1.9-2.3 length of vein R2+3, mean 2.1. *Abdomen*: Terga III-VII without lateral patches; basal triangular patches generally broader; posterior terga usually with pale scales along lateral scale-free areas and posterior border, these sometimes rather broad and more or less continuous with submedial pale spots, thus occasionally significantly reducing dark areas. *Genitalia* (Fig. 19): Form as figured; structure of phallosome somewhat as in *decens*. Ninth tergal lobes developed as usual, each with 7-14 (mode 9) irregularly spaced setae. Gonocoxite normal, ventrolateral surface with usual complement of strong setae, mesal setae longer and denser at base than usual, mesal surface also with 4 or 5 setae at apex, lateral surface with cluster of moderately long setae at and below level of subapical lobe (similar to *laticinctus* and *mattinglyi*); subapical lobe slightly divided, setae *a-c* long and tapered, *a* shorter and blunt at tip, *b* and *c* hooked apically; seta *d* absent, *e* simple, *f* flattened and bladelike with one edge thickened; seta *g* foliform, rather short and narrow, rounded apically; *h* simple, about same length as *g*, slightly curved distally. Gonostylus developed as usual. Phallosome longer than broad with lateral plates and aedeagal sclerites of nearly equal length; dorsal arm straight or bent laterad, tapered distally, apex pointed; lateral arm with 2-5 (mode 3) laterally-directed denticles at tip, a stubby dorsal process, and a rather weakly developed basal articulatory process; ventral arm poorly developed, slender, sinuous, only slightly longer than one of the larger denticles of lateral arm. Aedeagus rather conical; crest of aedeagal sclerite rather long, about same length as proximal part. Proctiger not unusual; paraproct with moderately long curved basal lateral arm and prominent ventral acetabulum, crown dark with numer-

ous spinelike spicules mesally and short blades laterally. Cercal sclerite elongate, irregular in outline; cercal setae 2-6 (mode 3). Tergum X straplike, articulating with paraproct below basal lateral arm.

Pupa (Fig. 19). Form and positions of setae as figured, range and modal number of branches in Table 9; resembling *univittatus*, *perexiguus*, *antennatus*, *simpsoni*, and *sinaiticus* in the character of setae 6-III and 3-VII, but usually distinguishable in having seta 1-II dendritic and the trumpet longer and flared. *Cephalothorax*: Lightly tanned; scutum with pair of irregular submedial moderately tanned spots, these sometimes subdivided; metanotum moderately tanned. Setae 1,2-CT usually with 4 branches (3-5); 6-CT with 3 or 4 branches; 8-CT usually with 5 branches (4,5); 9-CT double or triple; 10-CT generally with fewer branches than other species of the *pipiens* group (2-4); 11-CT double; 12-CT usually with 4 or 5 branches (3-5). *Trumpet*: Moderately tanned, pinna darker than usual; rather long and flared distally, index 4.1-6.2, mean 4.4; pinna oblique, rather long, 0.2-0.3 total length of trumpet. *Abdomen*: Lightly tanned, often with dark V-shaped stripe beginning at base of tergum I and gradually tapering to posterior margin of tergum IV, width of stripe on tergum I equals width of metanotum; length 3.0-3.7 mm, mean 3.5 mm. Seta 1-II dendritic, usually with fewer than 12 branches (7-16); 1-III-VII multiple, number of branches progressively fewer on each succeeding posterior segment, 1-III often with 10 or 11 branches (6-13), 1-VII frequently with 4 branches (3-6); 5-IV usually with 4 branches (2-4), 5-V,VI double, both distinctly longer than 5-III, about 1.5 length of following tergum; 6-III-VI variable, often with 3-5 branches (2-6). *Paddle*: Developed and tanned as usual; length 0.79-1.08 mm, mean 0.94 mm; width 0.72-0.82 mm, mean 0.74 mm; index 1.2-1.4, mean 1.3.

Larva (Fig. 20). Character and placement of setae as figured, range and modal number of branches in Table 29; resembles *simpsoni* and *sinaiticus* but differs from other members of the *pipiens* group in having comb scales with a distinct sharp apical spine, differs conspicuously from *simpsoni* and *sinaiticus* in the character of setae 5-C and 1-S. *Head*: Length 0.78-1.05 mm, mean 0.88 mm; width 1.28-1.54 mm, mean 1.37 mm; mainly lightly tanned, lateralia with rather distinctly delineated dark area behind each eye, dorsal apotome with 0-9 dark spots of variable size and distinctness behind seta 5-C (in 3 rows of 3 when all are present, largest at bases of seta 5-C and medially between bases of seta 5-C and posterior margin of head, 3-5 spots usually present). Dorsomentum most often with 6 teeth (5-8) on either side of median tooth. Seta 1-C stout, moderately tanned, sometimes barbed; 2-C absent; 4-C often double or triple, sometimes single; 5-C usually triple, occasionally with 4 branches; 6-C almost always double, seldom triple; 7-C often with 7 branches (6-10); 10-C with 3 or 4 branches occurring in nearly equal frequencies; 11-C normally double, seldom single; 12-C most often with 4 branches (3-6); 14-C usually double, infrequently single. *Antenna*: Length 0.60-0.80 mm, mean 0.70 mm; proximal part lightly tanned, distal part moderately tanned, with dark spot mesally at base; proximal part aciculate, aciculae coarser just before seta 1-A. Seta 1-A with about 22 branches (18-32). *Thorax*: Integument hyaline, surface smooth, tubercles of pleural setal groups moderately tanned; with distinctive somewhat hourglass-shaped internal body of black pigment extending from anterior margin to middle of metathorax, easily seen in larva resting at water's surface. Seta 7-P usually triple, infrequently with 4 branches; 8-P most often double, frequently triple. Seta 12-T usually double, sometimes single. *Abdomen*: Integument hyaline, lightly tanned, sometimes slightly darker dorsally; tubercles of larger setae lightly to moderately tanned. Seta 3-I usually double or triple (2-5), 3-VII most often with 5 branches (3-8); 6-I-VI almost always triple, 6-I-III distinctly longer than 6-IV-VI; 1-III,IV usually with 4 branches, 1-III occasionally with 5 branches, 1-IV infrequently with 3 or 5 branches,

1-V, VI usually triple, 1-V often with 4 branches, 1-VI sometimes double and infrequently with 4 branches. *Segment VIII*: Comb with 28-45 fringed scales (mean 35) with sharp apical spine. Seta 1-VIII most often with 7 branches (5-9); 3-VIII usually with 8 branches (7-10). *Siphon*: Index 4.15-5.36, mean 4.79; straight or very slightly sigmoid in lateral view; moderately tanned, sometimes slightly darker in middle, proximal 0.5 often very dark. Pecten of 8-13 long slender spines (mode 12) on basal 0.3 of siphon; spines with 3-5 short basal denticles. Seta 1-S usually comprised of 10 setae (7-13), two forming lateral pair, others imperfectly paired close to posterior midline. *Segment X*: Saddle complete; moderately tanned, sometimes dark along posterior margin; length 0.44-0.56 mm, mean 0.48 mm, siphon/saddle index 3.15-3.46, mean 3.33. Seta 1-X usually triple, occasionally double, sometimes with 4 branches; 2-X most often with 4 branches, often triple, sometimes with 5 branches; 4-X usually in 7 pairs, sometimes less 1 or 2 setae.

Systematics. Sirivanakarn (1976) placed *theileri* in a subgroup of its own and suggested that Afrotropical species such as *andersoni* Edwards, 1914a, and *simpsoni* might also be members of the group. It is still not known whether *andersoni* belongs to this group, but *simpsoni* and its close allies are sufficiently distinct from *theileri* to be placed in a separate subgroup. There are a number of intermediate Afrotropical forms which are not definitely assignable to either subgroup, so these subgroups may have to be redefined once the species are better known. The affinities of *laticinctus* and *mattinglyi* are not clear, but they resemble *theileri* in a number of characters and I am placing them provisionally in the *theileri* subgroup.

Culex theileri is a clearly marked species which is widely distributed in the Afrotropical, southern Palaearctic, and western Oriental regions. The larvae and adults, excluding the male genitalia, are extremely variable and exhibit the same degree of variation within local populations that is observed throughout the entire range. Therefore, it appears that only a single widespread and variable species is involved, yet it is possible that the taxon actually consists of an aggregate of biologically distinct, isomorphic species. This form needs to be thoroughly studied throughout its range.

I am certain that *Culex alpha* Séguy, 1924 is conspecific with *theileri*. There are two possible type larval specimens labelled as *alpha* in the Museum National d'Histoire Naturelle, Paris (Harbach, 1983) which are easily identified as *theileri*. Since there is no clear evidence to indicate that these larvae are type specimens, I have designated the larva illustrated by Séguy as the lectotype of *alpha*. This figure agrees in all essential details with the current concept of *theileri*.

Bionomics. *Culex theileri* is an adaptable species which utilizes a wide range of breeding sites, but it is also a focal species, reaching high densities in some areas while appearing to be rare or absent in others. The immature stages can breed in permanent or temporary bodies of fresh, brackish, or foul water. They are commonly found in stagnant or slow streams and irrigation ditches, swamps, marshy pools, ground pools, ponds, springs, disused wells, open cisterns, and seepage water. The breeding sites are usually sunlit and often contain little or no floating or emergent vegetation. Larvae are often found alone or in association with *pipiens*, *perexiguus*, or *antennatus*.

In southwestern Asia, this species reaches peak densities in late spring and early summer. Females feed mainly on mammals and are known to enter houses and bite man (Kirkpatrick, 1925; Gad, 1956; Anderson, 1967). This species does not seem to be involved in the transmission of any human diseases in southwestern Asia, but its importance as a vector has not been thoroughly studied. McIntosh et al. (1967) found it naturally infected with West Nile and Sindbis viruses in South Africa, but easy experimental transmission has been demonstrated only for Sindbis virus (Jupp et al., 1966).

Distribution. *Culex theileri* seems to have a discontinuous distribution in southern and eastern Africa, lands around the Mediterranean, southwestern Asia, southern USSR, southern China, India, and Burma.

Material examined. 1,452 specimens. A total of 1,337 specimens (311 females, 221 males, 62 male genitalia, 282 pupal exuviae, 161 larval exuviae, and 300 fourth-instar larvae) were examined from southwestern Asia — AFGHANISTAN: (Angur Abajhr, Bolla Quchi, Garwargin, Karukh, Sayedabat); EGYPT: *Aswan* (Aswan, El 'Aqaba el Saghira, Nag' Tingar, Sahara City), *El Burhayra* (Wadi Natrun – Bir Hooker, Ezbet Kafr Dawud), *El Fayyum* (Abhit el Haggat, Birket Qarun), *El Giza* (Saqqara), *El Isma'iliya* (Isma'iliya), *Marsa Matruh* (Siwa Oasis – Abul el Leef, Aghurmi, Ain Bundi, Masouse, Mshendit), *Sinai Peninsula* (unknown localities); IRAN: (Bisotun, Cham Asbi, Dorud, Ghasem Gheshlari, Kivi, Maragheh, Mazandaran, Mehrdasht, Mish Kazeroon, Natchi Bahrán, Semnan, Sharaf Khaneh); IRAQ: (Abu Ghraib, Amara, Baghdad, Barari Bela Musal, Basrah, Daurah, Erbil Town, Hadji Geul, Rawanduz Nahia, Shubaichas, unknown localities); ISRAEL: (Acre, Deir el Belah, Dhahiriya, Ein Ghridyan, Khedeira, Kishon River, Latron, Lake Huleh, Ludd, Marakeb, Ramat Razi'el, Shivta, Wadi Sharia); JORDAN: (Az Zarqa); PAKISTAN (localities east of the Indus River): (Gujranwalia, Jhelum, Lahore); P.D.R. YEMEN: (Jebel Jihaf); SAUDI ARABIA: (Gatib Oasis, Sabo); SYRIA: (Damascus, Deir el Aachair, Doumar, Kissoué); TURKEY: (Adana, Istanbul, Konya, Koyna-Eregli, Sinop-Boyobad, Tatvan); YEMEN ARAB REPUBLIC: (El Amra, Hada, San'a, Ta'izz). An additional 115 specimens (61 females, 38 males, 5 male genitalia, 1 pupal exuviae, 6 larval exuviae, and 4 fourth-instar larvae) were examined from ALGERIA, GREECE (CRETE) (including the holotype female of *creticus*), KENYA, INDIA (the type series of *pettigrewii*), LIBYA, NEPAL, SOUTH AFRICA (including the types of *theileri* and *onderstepoortensis*), TUNESIA, ZIMBABWE, and unknown localities.

***Culex (Culex) laticinctus* Edwards**

laticinctus Edwards, 1913a: 49. *Holotype male: Tiberias, Palestine, [Israel] (BM).

Culex sp. no. 2518 of Storey, 1918(1919): 101 (Egypt, A, L keys, A, M gen.*, L*).

Culex laticinctus Edwards of Barraud, 1921: 394 (Israel, Jordan, Syria, Egypt, L habitat, distr.); Buxton, 1923: 317 (Israel, Jordan, coll. rec., L bionomics); Theodor, 1923: 341 (Israel, Jordan, P*, key); Kirkpatrick, 1924(1925): 368, 371 (Egypt, A, L keys); Salem, 1938: 27 (Sinai); Parr, 1943: 246-250 (Lebanon, coll. sites, bionomics, A, P, L keys); Lewis, 1945: 17 (Sudan, distr.); Senevet, 1946: 317-321 (? North Africa, L*); Leeson and Theodor, 1948: 228 (Socotra, L habitat, coll. sites, A, L keys); Theodor, 1952: 113 (Middle East, zoogeogr.); Senevet et al., 1957a: 86 (North Africa, L*); Abul-hab, 1968: 249 (Iraq, L key); Margalit and Tahori, 1973: 90-93 (Sinai, distr., coll. sites, L bionomics); Margalit et al., 1973: 32 (Israel, coll. rec., L assoc.); Dimentmand and Margalit, 1981: 124-127 (Israel, L bionomics); Kitron and Pener, 1986 (Israel, L bionomics).

Culex (Culex) laticinctus Edwards of Edwards, 1921: 342 (Egypt, Israel, Jordan, Oman, A, L keys, tax., distr.); Séguy, 1924: 37, 190 (Egypt, Israel, Jordan, Oman, A, L keys, M gen.*, tax., distr., syn., not L in Figs. 20-23, Pl. II); Kirkpatrick, 1925: 119, 190 (Egypt, A, P, L keys, M*, F, P*, L*, bionomics, distr.); Edwards, 1926: 137 (Egypt, Israel, Jordan, Oman, A, L keys, A, L, distr.); Stackelberg, 1927: 160

(Middle East, M, F keys, A, M gen.*, distr.); Martini, 1931: 368 (Arabia ?, Egypt, Israel, Jordan, Syria, A, L keys, M*, F, L*, distr.); Edwards, 1941: 313, 420, 482 (Afrotropical Region, excluding records from Dhahran and San'a, A key, M*, F*, P, distr.); Lewis, 1943a: 282 (Eritrea, coll. rec., bionomic note); Senevet, 1947a: 123 (Egypt, Saudi Arabia, Syria, Turkey, L*, distr.); Abbott, 1948: 45 (Sudan, L, L habitat, distr.); Senevet, 1949: 56 (North Africa, M gen.*, key); Monchadskii, 1951: 263 (Middle East, L*, key, L assoc., distr.); Hopkins, 1952: 298 (Afrotropical Region, L*, key, bionomics); Knight, 1953a: 229 (Yemen Arab Republic, coll. rec.); Senevet and Andarelli, 1954: 58 (Israel, Jordan, A key, M, F); Abdel-Malek, 1956: 100 (Sinai, L bionomics, L key); Lewis, 1956: 710 (Sudan, Egypt, Eritrea, coll. sites, L habitat, distr.); Mattingly and Knight, 1956: 102-132 (Oman, P.D.R. Yemen, Socotra, Yemen Arab Republic, L*, A, L keys, distr., bionomics); Senevet et al., 1957b: 92 (North Africa, L); Parrish, 1959: 266 (Turkey, distr.); Senevet and Andarelli, 1959: 158 (North Africa, Mediterranean basin, A, P, L keys, M*, F*, P*, L*, distr., bionomics); Abdel-Malek, 1960: 113-120 (Syria, coll. sites, L bionomics, distr.); DuBose and Curtin, 1965: 352, 354 (Mediterranean area, A, L keys); Mekuria, 1968: 78 (Ethiopia, distr.); Lotfi, 1970: 401 (Iran, coll. rec.); Margalit and Tahori, 1970b: 152 (Israel, coll. sites); Lotfi, 1973: 206 (Iran, coll. site); Gutsevich et al., 1974: 345 (Middle East, L key); Lotfi, 1976: 73, 76, 83 (Iran, L key, ecol. note, L*); Margalit and Tahori, 1974: 87 (Israel, coll. rec., L assoc.); Harbach, 1985a: 86, 95, 103 (SW Asia, Egypt, distr., A, L keys).

Culex (Culex) mattinglyi Knight of ? Abdel-Malek, 1960: 120 (Syria, coll. sites, L bionomics, distr.); ? Abul-hab, 1968: 248 (Syria [based on report by Abdel-Malek, 1960: 120], L key).

Adult. A medium-sized mosquito easily recognized by the light-colored thorax, dark proboscis, absence of postspiracular and prealar scales, and the relatively broad basal pale bands of the abdominal terga. Individuals usually possess 2 or 3 lower mesepimeral setae.

FEMALE. *Head:* Length of antenna about 2.0 mm; flagellum normal; pedicel and flagellomere 1 with some small pale scales on mesal surface. Proboscis blackish, slightly paler on proximal 0.6 of ventral surface; length 2.2-3.1 mm, mean 2.7 mm. Maxillary palpus usually entirely black-scaled, palpomere 3 sometimes with few apical pale scales; length 0.4-0.6 mm, about 0.2 proboscis length. Forked scales of vertex long and slender, light yellowish brown; falcate scales white to pale yellowish, distinctly white along margin of eye; lateral spatulate scales white. *Thorax:* Pleural integument yellowish with tinge of brown, scutum not much darker. Scutal scales moderately coarse, light yellowish brown, white scales on anterior promontory, lateral margins, along prescutal suture and on prescutellar area; scutal setae prominent, brown, well contrasted with light-colored scales. Scutellum with narrow whitish falcate scales on all 3 lobes. Ante- and postpronota with long whitish to yellowish falcate scales; with 4-8 setae on posterodorsal margin. Pleura with yellowish to golden-brown setae and patches of narrow white spatulate scales: upper part of proepisternum with small patch of scales below 5-10 setae, postspiracular and prealar areas without scales, prealar area with 7-14 setae, upper part of mesokatepisternum with scale-patch and 5-7 setae, lower posterior border of mesokatepisternum with patch of semierect scales and row of 5-13 setae, mesepimeron with anterior and upper scale-patches and 5-14 setae on upper area; number of lower mesepimeral setae variable, commonly 2 or 3, often 1 (at least on one side) and occasionally 4. *Wing:* Dark-scaled with short line of whitish scales on posterior margin of costa near humeral crossvein; length 3.7-5.1 mm, mean 4.4 mm; length of cell

R2 2.6-4.3 length of vein R2+3, subcosta intersects costa beyond furcation of vein R2+3; length of cell M1 0.65-0.78 length of cell R2. *Halter*: Pedicel and scabellum pale; capitellum dark. *Legs*: Anterior surface of forecoxa with whitish scales, mid- and hindcoxae with longitudinal patch of narrow whitish scales on anterior side of lateral midline. All femora with inconspicuous whitish knee spots; anterior surface of fore- and midfemora with blackish scales, posterior surface white-scaled; hindfemur largely white-scaled, with dorsal stripe of black scales beginning 0.1-0.3 from base and gradually widening to encircle approximately distal 0.2. All tibiae black-scaled anteriorly, whitish-scaled posteriorly, apices of fore- and midtibiae inconspicuously pale-scaled, apex of hindtibia with conspicuous pale spot. Tarsi black-scaled with hint of paler scales on posterior surface of tarsomere 1. *Abdomen*: Tergum I with median posterior patch of white to light brown scales; terga II-VII black-scaled with basal 0.4-0.6 white-scaled; tergum VIII with lateral patches of cream-colored scales, broad median area without scales. Scaling of sterna I-VII entirely cream-colored; sternum VIII usually entirely white-scaled.

MALE. Differing from female as follows. *Head*: Antennal length 1.5-2.1 mm, mean 1.8 mm. Length of proboscis 2.3-2.9 mm, mean 2.6 mm; without ventral cluster of setae. Maxillary palpus barely if at all longer than proboscis, length 2.5-2.9 mm, mean 2.7 mm; scaling mainly dark, palpomere 3 with subtle subapical stripe of pale scales on ventrolateral margin, palpomere 4 with ventral stripe of white scales, and palpomere 5 with ventral spot of white scales at base. *Wing*: Length 3.3-4.2 mm, mean 3.7 mm; length of cell R2 1.3-2.3 length of vein R2+3, subcosta intersects costa before furcation of vein R2+3; length of cell M1/length of cell R2 0.6-0.8. *Abdomen*: Basal bands 0.45-0.75 tergum length; posterior edge of bands irregular, usually with submedial indentations of posterior dark scaling; bands produced posteriorly along lateral setae, particularly on terga VI and VII. *Genitalia* (Fig. 21): Form as figured; phallosome much as in *theileri*. Ninth tergal lobe small, with 4-9 (mode 5) small setae. Gonocoxite stout, ventral and mesal surfaces with usual complement of large and small setae respectively, mesal surface also with conspicuous clump of moderately long setae near base of gonostylus, lateral surface with rather dense covering of moderately long setae and some long slender setae at base; subapical lobe distinctly divided but not prominent, setae *a-c* stout, slightly flattened and bent distally, *a* about half as long as *c*, *b* intermediate; seta *d* absent, *e* and *f* resemble *a-c* but are more slender and distinctly flatter and broader distally, *e* about as long as *a*, *f* about as long as *c*; seta *g* a crescent-shaped blade with pointed tip; *h* slender, curved, and inconspicuous. Gonostylus relatively short, rather more sharply bent in middle than usual, with crest of small sharp ridges before tip. Phallosome constructed as in *theileri* but lateral plate longer than aedeagal sclerite, crest of aedeagal sclerite shorter, lateral arm of lateral plate with 3-7 (mode 4) apical denticles, and ventral arm more strongly developed, much longer than denticles of lateral arm. Proctiger almost as in *theileri*; ventral acetabulum of paraproct inconspicuous; cercal setae more numerous, 5-8 (mode 7).

Pupa (Fig. 21). Form and placement of setae as figured, range and modal number of branches in Table 10; distinguished from all the other species except *mattinglyi* by the strongly flared trumpet with its short tracheoid area and unusually short seta 6-I,II. *Cephalothorax*: Lightly to moderately tanned, scutum, legs, and metathorax darker. Setae 1,3,7,9-CT double or triple, more often double; 8-CT usually with 4 or 5 branches, sometimes with 6; 10- and 11-CT close set, 10-CT with variable number of branches (4-10), 11-CT usually double, occasionally single; 12-CT with 3 or 4 branches. *Trumpet*: Moderately tanned, tracheoid area darker; rather short and distinctly flared, index 2.8-3.7, mean 3.2; pinna 0.3-0.4 trumpet length; tracheoid area less than 0.3

trumpet length. *Abdomen*: Lightly tanned, anterior terga and sterna darker in middle, anterior and posterior margins of these darker still; length 3.5-4.0 mm, mean 3.8 mm. Seta 6-I,II short, only slightly longer than 7-I,II, single or double; 7-I usually triple, sometimes double; 7-II usually double, sometimes single; 1-II with short stem and only 7-14 branches; 10-II occasionally present, often only on one side, usually single, sometimes double or triple; alveolus of 11-II present; 6-III-VI usually triple (2-4); 5-IV shorter than 5-V,VI, about length of following tergum, most often with 4 branches (2-5); 5-V,VI normally double, distinctly longer than following tergum. *Genital lobe*: Moderately tanned; larger than usual, length about 0.25 mm in female, about 0.50 mm in male; female with short ventromesal pointed process projecting cephalad from base; male with pair of bumps at base ventrally. *Paddle*: Very lightly tanned, buttress and midrib darker; inner part widest distally; length 1.00-1.15 mm, mean 1.09 mm, width 0.83-1.00 mm, mean 0.91 mm, index 1.1-1.3, mean 1.2.

Larva (Fig. 22). Character and positions of setae as figured, range and modal number of branches in Table 30; easily distinguished from all other *Culex* in southwestern Asia by the combination of seta 6-III-VI normally single and 2-X with 4 or 5 branches, resembling *decens* and *duttoni* in the character of seta 6-III-VI, and many specimens of *theileri*, *sitiens*, *poicilipes*, and *bitaeniorhynchus* in the branching of seta 2-X. *Head*: Length 0.77-1.04 mm, mean 0.91 mm; width 1.10-1.54 mm, mean 1.33 mm; mainly lightly tanned, darker ventrally (mainly gula) and posteriorly (particularly lateralia); ventral ecdysial line distinct from level of seta 15-C to posterior margin of gula. Dorsomentum usually with 7 or 8 teeth (7-9) on either side of noticeably larger median tooth. Seta 1-C long and rather stout; 2-C present or absent; 5,6-C shorter than usual, reaching only slightly beyond anterior margin of median labral plate; 5-C usually with 4 or 5 branches, seldom with 6; 6-C usually with 4 branches, sometimes triple; 8-C frequently with 4 or 5 branches (3-6); 10-C usually triple (2-5); 14-C double or triple, more often triple. *Antenna*: Length 0.53-0.68 mm, mean 0.62 mm; lightly tanned before seta 1-A, distal part darker, with usual dark mesal spot at base; aciculate as usual, aciculae slightly shorter and broader near seta 1-A. Seta 1-A with about 23 branches (19-26); 2,3-A distinctly subapical. *Thorax*: Integument hyaline; surface smooth. Seta 7-P with 3 or 4 branches, more often with 3; 8-P double. Setae 1,2-M about same length, both frequently triple (1-4 and 1-5 respectively). Seta 12-T double or triple, more often double; 13-T smaller than usual, with 7-11 branches. *Abdomen*: Integument hyaline; surface smooth. Seta 3-I usually with 3 or 4 branches (2-7), 3-VII frequently double or triple, sometimes with 4 branches; 6-I,II usually triple, infrequently with 4 branches, 6-III,VI normally single, 6-III,IV occasionally double; 1-III most often single, sometimes double, 1-IV,V single, long, about 1.5 length of segment, 1-VI almost always single and long, seldom double, 1-VII with fewer branches than usual, double or triple, more often double. *Segment VIII*: Comb with 24-38 (mean 32) evenly fringed scales, fringe longer at apex. *Siphon*: Index 3.07-4.18, mean 3.48; subcylindrical, broadest at base and tapering distally; moderately tanned, slightly darker at base and apex. Pecten on approximately basal 0.4, composed of 10-16 (mode 12) long curved spines with 3 or 4 basal denticles. Seta 1-S usually represented by 14 setae but 12-15 may be present, 2 paired laterally near tip, others more or less paired along posterior midline, 2 proximal pairs within pecten, lateral and most distal pair smaller and with fewer branches than the others. *Segment X*: Saddle complete; moderately tanned, darker on anterior and posterior margins; length 0.36-0.48 mm, mean 0.42 mm, siphon/saddle index 2.78-3.24, mean 3.02. Seta 1-X single or double, more often double; 2-X with 4 or 5 branches (Kirkpatrick, 1925 reported 5 or 6); 4-X almost always in 7 pairs, infrequently with 6 paired and 1 unpaired seta.

Systematics. The adults of *laticinctus* bear little resemblance to those of *theileri* except for a remarkable similarity in the structure of the male phallosome. The larva of this species is generally similar to that of *theileri*, but the comb scales and setae 1,6-III-VI are very different. In spite of these differences I am including both *laticinctus* and *mattinglyi* in the *theileri* subgroup because *mattinglyi*, which seems to be very closely related to *laticinctus*, exhibits some characters in the adult and larval stages which are intermediate in development between those in *laticinctus* and *theileri*.

Culex laticinctus and *theileri* are sympatric throughout the arid lands of northern Africa and southwestern Asia where they were once equally common species. Today, *laticinctus* seems to be less common than *theileri*. The reason for this is unknown, but it may be due to human influence. In 1983 I had the opportunity to collect mosquitoes all over the Nile Delta area of Egypt with Bruce A. Harrison and we never found *laticinctus*, not even in the vicinity of Alexandria where it was once quite common (Kirkpatrick, 1925). We examined a number of specimens in the Dokki Institute and the Entomological Society of Egypt in Cairo which came from near Alexandria during Kirkpatrick's time, but no other specimens of *laticinctus* were present in either repository.

The presence of two or three lower mesepimeral setae has been used extensively to distinguish this species from other species of *Culex* known to occur in the Afrotropical and Mediterranean regions. This character, however, is not as reliable as it was previously thought to be. Many specimens examined during this study, especially from Israel, have only one lower mesepimeral seta on both sides of the thorax. This condition is reflected in the key presented above.

Bionomics. *Culex laticinctus* seems to have been more common in the past than it is today. It was once collected frequently in artificial containers such as cisterns, tanks, barrels, wells, concrete basins, and similar structures. Now it seems to be found more often in stream pools, rock pools, swamps, springs, irrigation ditches, and temporary ground water. It also uses seepages (Kitron and Pener, 1986) and has been found in animal hoofprints supplied with water by a spring (Abdel-Malek, 1960). This species usually occurs in fresh water, but is found occasionally in slightly brackish water. It is frequently collected in association with *Anopheles* (*Anopheles*) *claviger* (Meigen) and *Culiseta* (*Allotheobaldia*) *longiareolata* (Macquart). It has also been found in association with *Anopheles* (*Cellia*) *hispaniola* (Theobald), ? *An. (Cel.) multicolor* Cambouliu, *An. (Cel.) sergentii* (Theobald), *Aedes* (*Ochlerotatus*) *caspius* (Pallas), *Culiseta* (*Culiseta*) *annulata* (Schrank), *Uranotaenia* (*Pseudoficalbia*) *unguiculata* Edwards, *Culex* (*Barraudius*) *pusillus* Macquart, *Cx. (Maillotia) hortensis* Ficalbi, and several members of the subgenus *Culex*, including *mimeticus*, *perexiguus*, *pipiens*, *sinaiticus*, *theileri*, and *tritaeniorhynchus*. *Culex laticinctus* is mainly a summer species but specimens can be found during most of the year. Resting adults have been captured in tents, a tub, and an ice factory, but it is not known whether females enter houses or bite man.

Distribution. This species is apparently widespread from the Canary Islands eastward through lands around the Mediterranean, Equatorial Africa, Sudan, Ethiopia, Somalia, the Arabian Peninsula, and the Middle East.

Material examined. 481 specimens. A total of 400 specimens (103 females, 109 males, 21 male genitalia, 67 pupal exuviae, 53 larval exuviae, and 47 fourth-instar larvae) were examined from southwestern Asia — EGYPT: *Sinai Peninsula* (Mt. Abas), unknown (Ibrahimien, Moharem Bey); IRAN: (Nanrizac Borazjun); ISRAEL (including the holotype male): (Ein Turieba, Haifa, Jericho, Jerusalem, Mont Fort, Mt. Carnish, Rahm Alla, Lake Tiberias, Wadi Faria, Yeroham); JORDAN: (Aqaba, Wadi Ram); LEBANON: (N. Damdur); OMAN: (Muscat, unknown localities); P.D.R. YEMEN: (Amd Town, Anag,

Awabil, Geidun, Khirbat Bakarman, Khalla, Mikhuras, Mukalla, Nafhun, N'Air, Saha, Shu'abat Amudi, Wadi Amd, Wadi Duan); SAUDI ARABIA: (Hima, Jeddah, Qunfida); SYRIA: (Baalbelk); YEMEN ARAB REPUBLIC: (Ta'izz). An additional 81 specimens (35 females, 24 males, 4 male genitalia, 1 pupal exuviae, 6 larval exuviae, and 11 fourth-instar larvae) were examined from ALGERIA, GREECE (CRETE), ETHIOPIA, LIBYA, MOROCCO, SOCOTRA, SUDAN, TUNISIA, and an unknown locality.

***Culex (Culex) mattinglyi* Knight**

mattinglyi Knight, 1953b: 320. +Holotype male: Birket Shiekh Kunnaf, San'a, Yemen Arab Republic (NMNH).

Culex (Culex) laticinctus of Edwards, 1941: 313 (records from Zahran, Saudi Arabia, and San'a, Yemen Arab Republic).

Culex (Culex) mattinglyi Knight of Knight, 1953b: 214-219 (Yemen Arab Republic, coll. rec.); Mattingly and Knight, 1956: 94-134 (Saudi Arabia, Yemen Arab Republic, A, L keys, distr., bionomics); Harbach, 1985a: 86, 95, 103 (Saudi Arabia, Yemen Arab Republic, distr., A, L keys).

Described chiefly from the type series.

Adult. A medium-sized yellowish-brown species markedly similar to *laticinctus*, differing in having normally only 1 lower mesepimeral seta and a line of pale posterior scutal fossal scales that is continuous with a posterior line of pale outer dorsocentral scales. The thoracic integument is generally darker and the male genitalia are distinctive.

FEMALE. *Head:* Antennal length 2.0-2.5 mm, mean 2.3 mm; pedicel and first flagellomere largely yellow or yellowish brown, rest of flagellum dark; mesal surface of pedicel dark with patch of tiny setae and pale scales; ventromesal surface of first flagellomere with patch of whitish scales. Proboscis dark-scaled, labella lighter; with 3-5 large basal labial setae and number of smaller decumbent setae just anterior to them; long and slender, length 2.9-3.2 mm, mean 3.1 mm. Maxillary palpus dark-scaled; length about 0.6 mm, approximately 0.2 proboscis length; palpomere 2 usually with 2 or 3 strong lateral setae. Vertex with narrow pale yellow falcate scales, whitish on ocular line and interocular space; forked scales brownish, darker posteriorly; lateral spatulate scales narrow, yellowish white. *Thorax:* Integument yellowish brown, darker dorsally. Scutum with narrow golden-brown falcate scales; scales whitish to pale yellow on margins and prescutellar area; pale line of posterior scutal fossal scales continuous with concolorous posterior line of outer dorsocentral scales; broad strip of bare integument between distinct lines of acrostichal and dorsocentral scales; approximately 13 well developed lateral prescutellar setae on each side. Scutellum with narrow pale yellow falcate scales; lateral lobes each with 4-10 and median lobe with 7-10 large setae. Ante- and postpronota with mainly broad yellowish-white spatulate scales, some narrow ones anteriorly; postpronotum with 5-8 setae on posterodorsal margin. Pleura with rather small patches of yellowish-white spatulate scales below upper proepisternal setae, on upper corner and lower posterior border of mesokatepisternum, at middle of anterior area of mesanepimeron and among upper mesepimeral setae; pleural setae golden brown: 5-8 upper proepisternal, 8-13 prealar, 5-7 upper mesokatepisternal, 5-10 lower mesokatepisternal, 10-16 upper mesepimeral, and normally 1 lower mesepimeral (2 on one side of thorax in 1 female and 1 male examined). *Wing:* Length 5.4-5.7 mm, mean 5.5 mm; length of cell R2 3.3-4.4 length of vein R2+3, mean 3.6; length of cell M1

0.8-0.9 length of cell R2; dark-scaled with small patch of pale scales on posterior margin at base of costa, all scales narrow, those on veins Rs, R2+3, R1 and R2 noticeably longer. *Halter*: Integument dark with whitish scales covering scabellum and capitellum. *Legs*: Anterior surface of forecoxa pale-scaled, with about 6 small setae and several indistinct pale scales in short row posteriorly at apex; midcoxa with anterior patch of pale scales; hindcoxa with narrow longitudinal stripe of pale scales on anterior side of lateral midline. Ventral and posterior surfaces of trochanters covered with small white spatulate scales. Fore- and midfemora dark-scaled anteriorly, pale-scaled posteriorly, with narrow knee spots of pale scales; hindfemur mainly pale-scaled with dorsal stripe of dark scales beginning at base and expanding over anterior and posterior surfaces on distal 0.3-0.4, dark scaling sometimes forming complete ring distally, apex with knee spot of yellowish scales. Tibiae dark-scaled, slightly paler posteriorly, apex of each with ring of yellowish scales. Tarsi entirely dark-scaled. *Abdomen*: Tergum I with median posterior patch of pale scales; tergum II with more or less convex basal pale band not reaching lateral margins (one female in BM with median posterior extension of pale band); terga III-VII with broad basal white bands, bands 0.3-0.5 tergum length, straight on terga III-V, slightly concave on terga VI and VII; tergum VIII with concave basal pale band, band sometimes obsolete in middle. Sterna entirely whitish-scaled; sternum VIII with lateral scale-patches only, broad median area void of scales.

MALE. Differing from female as follows. *Head*: Length of antenna about 2.0-2.5 mm; pedicel and flagellomere 1 without scales. Maxillary palpus dark-scaled; with some indistinct pale scales in dorsomesal line on distal 0.33 of palpomere 3, on ventral surface of palpomere 4, and ventrally at base of palpomere 5; palpomeres 4 and 5 sparsely setose, long setae mainly on palpomere 4; length about same as proboscis. *Wing*: Pale scales absent at base of costa (few present at humeral crossvein in one specimen examined). *Abdomen*: Terga and sterna same as in female except those of segment VIII entirely pale-scaled. *Genitalia* (Fig. 23): Form as figured; phallosome resembling that of *theileri* and *laticinctus*. Ninth tergal lobes more widely separated than usual, each with 3-8 unevenly spaced setae. Gonocoxite enlarged, ventral and mesal surfaces with setae developed as usual, dorsolateral surface with very dense vestiture of moderately long hairlike setae; subapical lobe prominent, very near tip of gonocoxite, undivided; seta *a* well removed proximally from *b* and *c*, rather slender and curved, *b* long, sinuous and stout at base, *c* shorter, more slender and slightly hooked at tip; *d-f* represented by 3 fine simple setae on mesal side of lobe; *g* narrow and pointed; *h* rather short, slender and nearly straight. Gonostylus notably expanded, with a conspicuous recurved thornlike process on mesal side at tip. Lateral plate of phallosome differing from that of *laticinctus* in having a smaller dorsal arm, stouter ventral arm, and lateral arm with variable number of tiny elevations in addition to 2-6 (mode 5) distinct small denticles. Proctiger not much different than in *laticinctus*; basal lateral arm of paraproct not as large; cercal setae generally fewer in number (2-6, mode 4).

Pupa (Fig. 23). Known from a single specimen in the type series; form and placement of setae as figured, number of branches in Table 11; apparently similar to *laticinctus*, seemingly differing in most of the following. *Cephalothorax*: Setae 8,12-CT double; 11-CT with 4 branches; 13-CT present, small. *Trumpet*: Index about 4.0; pinna slightly longer. *Abdomen*: Length 3.8 mm. Seta 6-I,II multiple; 10-II with distinct stem and many branches; alveolus of 11-II absent; 5-V,VI single, 5-VII much shorter than 4-VII. *Paddle*: Length about 1.20 mm; width about 0.95 mm; index about 1.3.

Larva (Fig. 24). Character and positions of setae as figured, range and modal number of branches in Table 31; resembles *laticinctus* but differs constantly in having the thorax covered with minute spicules, seta 6-VI double, and seta 2-X double or triple.

Head: Length 0.94-1.05 mm, mean 0.99 mm; width 1.26-1.48 mm, mean 1.37 mm; moderately tanned, slightly to distinctly darker behind eyes. Dorsomentum with 9-12 (mode 10) teeth on either side of median tooth. Seta 1-C long and slender; 2-C present; 5,6-C long, 5-C usually with 4 branches (3-5), 6-C normally triple, infrequently with 4 branches; 8-C most often triple (2-4); 10-C forked, often triple (2-5); 14-C single. **Antenna:** Long and slender, length 0.70-0.78 mm, mean 0.73 mm; lightly to moderately tanned, distal part darker, basal rim and mesal spot at base more heavily tanned. Seta 1-A with about 21 branches (18-26); 2,3-A subapical as in *laticinctus*. **Thorax:** Integument hyaline; covered with tiny spicules. Seta 7-P appreciably longer than usual, usually double (2-4). Seta 1-M longer than 2-M, single; 2-M most often with 4 branches (2-4). Seta 12-T single; 13-T short as in *laticinctus* but with fewer branches (4-7). **Abdomen:** Integument hyaline, smooth. Seta 3-I usually triple, seldom double, 3-VII usually double, sometimes single; 6-I-IV with 2-5 branches, 6-I,IV usually double, 6-II,III usually triple; 6-V,VI usually double, sometimes triple; 1-IV-VI single or double, 1-VI more often single. **Segment VIII:** Integument with minute spicules, particularly around comb. Comb with 29-48 (mean 38) scales. **Siphon:** Index 3.40-4.55, mean 4.03; more or less distinctly swollen before middle, apex narrowed. Pecten with 13-22 (mode 16) spines; most spines with 2 basal denticles (1-3). Seta 1-S usually composed of 14 setae (7 pairs) but 11-16 may be present, paired and developed as in *laticinctus*. **Segment X:** Saddle complete, broader than long; moderately tanned, darker dorsally; posterodorsal margin conspicuously spiculate; length 0.37-0.42 mm, mean 0.39 mm, siphon/saddle index 3.90-4.64, mean 4.19. Seta 1-X double or triple, more often triple; 2-X double or triple; 4-X usually comprised of 12 setae (6 pairs), sometimes 11 or 13 are present.

Systematics. *Culex mattinglyi* is clearly indigenous to the southwestern mountains of the Arabian Peninsula where it is restricted to higher terrain. This species is undoubtedly derived from the same stock as *laticinctus*. The two species are so similar that Edwards (1941) failed to recognize specimens of *mattinglyi* from San'a, Yemen Arab Republic, and Zahran, southwestern Saudi Arabia, as a species different from *laticinctus*. In fact, the author of *mattinglyi* did not realize that the type series was distinct from *laticinctus* until he removed and examined the male genitalia (Kenneth L. Knight, personal communication). The adults of *mattinglyi* differ in normally having only one lower mesepimeral seta and a diffuse line of pale scales on the scutum. The males differ markedly in the development of the gonocoxite and gonostylus. Conspicuous differences in the larval stage include the minutely spiculate thorax and the differently developed setae 6-VI and 2-X. The pupa of *mattinglyi* is known from only one specimen in the type series so it is probably much more difficult to distinguish from that of *laticinctus* than it appears to be in the key.

Culex mattinglyi and *laticinctus* differ conspicuously from *theileri* in the ornamentation of the adult, the structure of the comb scales of the larva, and the development of setae 1,6-II of the pupa. *Culex mattinglyi* seems to be intermediate between *theileri* and *laticinctus* with respect to the general pigmentation of the adult, the structure of the gonocoxopodite of the male, and the development of setae 1,6-III-VI of the larva. I consider *mattinglyi* and *laticinctus* to be members of the *theileri* subgroup because of the intermediate nature of *mattinglyi*. The male phallosome of these species is undoubtedly of the type found in *theileri*, and it is difficult to believe that this striking similarity is due to convergence.

Bionomics. Knight (1953b) found the immature stages of this species in a cement watering trough, a broad open well, a large cement basin, and a large cement tank. Adults misidentified as *laticinctus* by Edwards (1941) were collected in a house. Other than this nothing is known about the bionomics or disease relations of this

species.

Distribution. *Culex mattinglyi* is known only from the highlands of the Yemen Arab Republic and a single locality near its northern border in Saudi Arabia.

Material examined. 42 specimens (11 females, 5 males, 5 male genitalia, 1 pupal exuviae, 11 larval exuviae, and 9 fourth-instar larvae) were examined from southwestern Asia — SAUDI ARABIA: (Zahran); YEMEN ARAB REPUBLIC (mostly type specimens): (Al-Asr, Rauda, San'a, Wadi Dhahr).

Culex (Culex) simpsoni Theobald

simpsoni Theobald, 1905c: 28. +Lectotype male, hereby designated, bearing following data: "46 // Type // Transvaal / Simpson // Culex / simpsoni / (Type) F.V.T. // Recd. from / F.V. Theobald, / 1907-29."; genitalia on acetate strip (BM).

richteri Ingram and De Meillon, 1927: 72. +Lectotype male, hereby designated, bearing following data: Museum type label with "Culex" written above and "richteri / [illegible mark]" written below the word "Type" // "[Begamuzi River], Zululand. / 1927. / Dr. A. Ingram. / B.M. 1928-27." (BM). Synonymy with *simpsoni* by Edwards, 1932a: 210.

mauritanicus Callot, 1940: 362. +Cotypes (larvae): Taghjicht, Morocco (IPS; slide with 3 larvae retained in NMNH). NEW SYNONYMY.

Culex simpsoni Theobald of Edwards, 1913b: 58 (Africa, A, M gen.); Lewis, 1945: 16 (Sudan, distr.).

Culex (Culex) simpsoni Theobald of Edwards, 1941: 309, 420, 482 (Afrotropical Region, A key, M*, F, P, syn., distr.); Lewis, 1943a: 282 (Eritrea, coll. rec., L bionomic note); Hopkins, 1952: 293 (Afrotropical Region, L key, L*, bionomics); Knight, 1953a: 215, 218, 230 (Yemen Arab Republic, coll. rec., M, distr.); Lewis, 1956: 709 (Sudan, coll. sites); Mattingly and Knight, 1956: 94-132 (Yemen Arab Republic, A, L keys, distr., bionomics); Ovazza et al., 1956: 172 (Ethiopia, coll. sites, L assoc.); Harbach, 1985a: 86, 93, 106 (Yemen Arab Republic only, distr., A, L keys).

Described chiefly from specimens collected in eastern Africa.

Adult. This and the following species resemble *univittatus* and *perexiguus* in most respects, but are easily distinguished by the absence of an anterior pale stripe on the hindtibia. They also lack a spot of pale scales at the base of the costa.

FEMALE. Proboscis, maxillary palpus, legs and abdominal terga largely clothed in dark brown scales. *Head:* Antenna dark, pedicel with pale scales on dorsomesal surface; length 1.6-1.9 mm, mean 1.7 mm. Proboscis with pale scaling in middle of ventral surface, sometimes forming more or less complete ring; length 1.6-2.0 mm, mean 1.8 mm. Maxillary palpus with some pale scales dorsomesally at apex; length about 0.4 mm, approximately 0.2 proboscis length. Falcate scales of vertex coarse, yellowish white; forked scales long, yellowish medially, dark laterally; ocular scales elongate, white, continuous with elongate white spatulate scales of postgenal area. *Thorax:* Integument brown. Scutum with yellowish and golden-brown falcate scales, often forming pattern consisting of median stripe on anterior 0.5, patches on fossae and pair of diffuse patches behind middle; with paler scaling on anterior and lateral margins, posterior dorsocentral area and lateral prescutellar area. Scutellum with white to very pale yellow

falcate scales mainly on median lobe, scales larger on median lobe and projecting laterad on either side of midline. Ante- and postpronota with some golden-yellow falcate scales, longer on anteprenotum. Pleura with patches of broad white spatulate scales as follows: patch ventral and mesal to upper proepisternal setae, patch on postspiracular area near spiracle, small patch below prealar knob, larger patches on upper corner and lower posterior border of mesokatepisternum, anterior patch on mesepimeron about same level and size as upper mesokatepisternal patch, and small patch before upper mesepimeral setae. Pleural setae golden brown, numbers follow: 4-6 upper proepisternal, 6-10 prealar, 4-6 upper mesokatepisternal, 4-7 lower mesokatepisternal, 3-5 upper mesepimeral, and 1 lower mesepimeral. *Wing*: Length 3.0-3.5 mm, mean 3.2 mm; length of cell R2 2.0-2.5 length of vein R2+3; length of cell M1 about 0.8 length of cell R2; entirely dark-scaled. *Halter*: Pedicel and scabellum pale; capitellum dark brown. *Legs* (hindleg, Fig. 2L): Forecoxa pale-scaled with dark scales in middle; mid- and hindcoxae with longitudinal line of pale scales on anterior side of lateral midline, scales slightly more numerous on hindcoxa. Femora with narrow knee spots of white scales; anterodorsal surface of forefemur dark-scaled, posteroventral surface white-scaled; midfemur dark anteriorly, dark scaling expanded over dorsal surface toward apex, posterior surface white-scaled; hindfemur largely white-scaled, with narrow dorsal stripe of dark scales beginning near base and abruptly widening to encircle femur on distal 0.2. Tibiae with spots of white scales dorsally at apex, large and conspicuous on hindtibia; fore- and midtibiae dark-scaled anteriorly, pale-scaled posteriorly; hindtibia very dark, nearly black on dorsal surface. Tarsi entirely dark-scaled. *Abdomen*: Tergum I with large median patch of brown scales; terga II-VII with distinct, slightly convex, white basal bands that are narrowly joined to basolateral spots of same color, bands 0.20-0.35 tergum length; tergum VIII normally entirely white-scaled. Sterna with broad dark apical bands (0.45-0.50 sternum length), usually produced anteriorly in middle; sternum VIII with lateral patches of pale scales only.

MALE. Like female except as follows. *Head*: Proboscis sometimes with few pale scales ventrally at base; length shorter, about 1.4 or 1.5 mm. Maxillary palpus dark brown; lateral surface of palpomere 3 with median patch of white scales; palpomere 4 with ventral line of white scales on proximal 0.5; palpomere 5 with ventral spot of white scales at base. Scales of vertex generally paler. *Wing*: Slightly shorter, 2.6-3.1 mm, mean 2.9 mm; length of cell R2 1.6-2.1 length of vein R2+3. *Legs*: Midfemur sometimes with very narrow line of pale scales on anterior surface. *Abdomen*: Terga without basolateral pale spots. Sterna sometimes almost entirely dark-scaled, with basolateral pale spots; tergum VIII (ventral in position) entirely dark-scaled or with narrow posterior band of pale scales. *Genitalia* (Fig. 25): Form as figured; general structure of phallosome as in *decens*. Ninth tergal lobe not produced, with 5-10 (mode 7) short setae. Gonocoxite normal, ventral and mesal setae developed as usual, lateral setae in 2 rows of 4 or 5 setae each; subapical lobe undivided, setae *a-c* of the usual form, group *d-e* absent, *f* stout (on order of magnitude of *a-c*), tapered and flattened apically, *g* asymmetrical (triangular) and rounded apically, *h* gently curved. Gonostylus narrow, tapered; gonostylar claw rather broad, flattened and curled. Phallosome longer than broad, lateral plate larger than aedeagal sclerite; dorsal arm more or less straight, diverging slightly from its mate of the opposite side; lateral arm with graded series of laterally directed denticles on caudal margin, 2-5 (mean 4) larger denticles project over 13-23 (mean 18) smaller denticles which grade into small bumps laterally, small denticles extend onto prominent dorsal process; ventral arm much as in *decens*. Proctiger unmodified; paraproct with long, curved, rodlike basal lateral arm and distinct ventral acetabulum. Cercal setae most often 3 (2-4).

Pupa (Fig. 25). Not associated with adults from southwestern Asia; form and placement of setae as figured, range and modal number of branches in Table 12; much the same as *antennatus*, but generally smaller, as reflected in the length of the abdomen and paddle, and pinna of trumpet usually shorter. *Cephalothorax*: Not distinguishable from *antennatus*. *Trumpet*: Index 4.6-6.3, mean 5.2; pinna short, usually less than 0.2 trumpet length. *Abdomen*: Length 2.2-2.6 mm, mean 2.4 mm. Seta 1-II not so variable, generally with fewer branches (12-19); 6-III,IV like 6-V,VI, often with 5 branches (4-6). *Paddle*: Length 0.63-0.77 mm, mean 0.69 mm; width 0.48-0.59 mm, mean 0.50 mm; index 1.3-1.6, mean 1.4.

Larva (Fig. 26). Not associated with adults from southwestern Asia; character and positions of setae as figured, range and modal number of branches in Table 32; this and the next species are readily separable from all other species of *Culex* in southwestern Asia by the combined character of seta 5-C, seta 14-P, and the comb scales. *Head*: Length 0.58-0.72 mm, mean 0.64 mm; width 1.01-1.14 mm, mean 1.06 mm; lightly tanned, darker behind eyes. Dorsomentum with 4-6 teeth on either side of median tooth, third from center distinctly larger. Seta 1-C long, slender, pale; 2-C absent; 4-C rather smaller than usual; 5-C single or double, most often single; 6-C usually double, occasionally single; 10-C usually triple (2,3); 11-C double; 13-C most often triple, sometimes with 4 branches; 14-C normally double with markedly divergent branches (2-4). *Antenna*: Length 0.50-0.66 mm, mean 0.60 mm; proximal part lightly tanned with dark basal ring contiguous with dark basomesal spot, distal part moderately tanned. Seta 1-A with about 27 branches (17-33). *Thorax*: Integument hyaline, smooth. Setae 4,7-P with 3 or 4 branches, 4-P more often with 4, 7-P most often triple; 14-P normally double, sometimes single on one side. Seta 1-M usually single, seldom double, longer than 2-M; 5-M shorter than usual. Seta 1-T normally single, seldom double, 0.5 or less length of 2-T; 2-T usually double, rarely single, occasionally triple; 13-T usually with 5 or 6 branches (5-7). *Abdomen*: Integument hyaline, smooth. Seta 3-I-IV double (3-I occasionally triple), 3-V,VI single, 3-VII variable (2-5); 6-I-VI normally triple (see table); 7-I usually double, sometimes single; 1-II-V with 4 or 5 branches, 6-VI with 3 or 4 branches, 6-VII often with 5 or 6 branches (4-7). *Segment VIII*: Comb with 17-36 scales, mean 28; most scales with sharp apical spine, some anterior scales fringed entirely, apical spine usually larger on posterior scales. *Siphon*: Index 5.14-5.67, mean 5.40; slender, tapered, broadest at base; lightly tanned, basal rim and acus moderately tanned. Pecten on proximal 0.33 or less, composed of 9-14 (mode 12) rather long slender spines with tiny basal denticles. Seta 1-S in 4 pairs, 1a-S occasionally within pecten, 1b- and 1c-S out of line with the others; usually double or triple (see table). *Segment X*: Saddle lightly tanned, with very inconspicuous posterodorsal spicules; length 0.35-0.39 mm, mean 0.37 mm, siphon/saddle index 2.98-3.97, mean 3.85. Seta 1-X usually triple, sometimes double; 2-X double, triple, or with 4 branches occurring in nearly equal frequencies; 4-X almost always in 6 pairs.

Systematics. The *simpsoni* subgroup is erected for *simpsoni* and *sinaiticus*, and also undoubtedly includes *striatipes* Edwards, 1941, *terzii* Edwards, 1941, and *seldeslachtsi* Wolfs, 1947 from the Afrotropical Region. The group is homogeneous in all essential adult and larval features. The adults resemble *univittatus* in ornamentation and coloration, but differ markedly in the male genitalia. The male genitalia resemble the type found in the *decens* subgroup, but the species are otherwise distinct in all life stages. The larvae share some characteristics with *theileri*, particularly the form of the comb scales, but differ conspicuously in the position and development of seta 1-S.

Culex simpsoni shows relatively little variation in adult characters, particularly the male genitalia. The larva is somewhat variable in details of the comb and siphon, but

there is no indication that more than one species is involved in the various separated populations examined. During this study, several individually reared specimens from Morocco previously identified as *Culex mauritanicus* Callot, 1940, and three cotype larvae of this nominal species, were examined and found to be remarkably similar to the type specimens of *simpsoni* and *richteri* in all important features. The similarities are so evident in all stages that for the present I cannot consider *mauritanicus* as a distinct species.

The occurrence of *simpsoni* in southwestern Asia is based upon two males collected in the Yemen Arab Republic (Knight, 1953a). The association of the immature stages with the adults is based on a small number of individual rearings from Tanzania and Morocco, and the type series of *richteri*. The unknown stages of *simpsoni* in southwestern Asia should agree with the descriptions above based on the overall conformity of the males with African specimens.

Bionomics. *Culex simpsoni* is found in a wide variety of habitats, but its original breeding places were probably sunlit pools of slow or stagnant water along streams or streambeds. Besides these habitats, *simpsoni* is commonly found in lakes, ponds, marshes, puddles, furrows, seepage pools, and artificial pools such as tubs, wells, troughs, and tanks. Ribeiro and Mexia (1966) collected larvae in relatively saline marshes and ground pools with somewhat turbid water and muddy bottom in Angola. Larvae have been found in association with *Anopheles (Cellia) cinereus* Theobald, *An. (Cel.) pharoensis* Theobald, *An. (Cel.) sergentii* (Theobald), *Culex theileri*, and *Cx. (Maillotia) arbieeni* Salem (as *jenkinsi* Knight) in southwestern Asia (Knight, 1953a), with *An. (Cel.) arabiensis* Patton (as *gambiae* Giles) in Uganda (Harris, 1942), and with *Culex antennatus*, *Cx. species near infula* Theobald (as *bitaeniorhynchus* Giles), and *Cx. (Culex) thalassius* Theobald in Angola (Ribeiro and Mexia, 1966). Nothing is known about the vector potential of this species, but it is not likely to be of importance in disease transmission because it only rarely bites man (Mattingly and Brown, 1955).

Distribution. This species is widely distributed in the Afrotropical Region and is known to occur in the northwest African countries of Mauritania and Morocco.

Material examined. 229 specimens. Only 4 specimens (1 female, 2 males, and 1 male genitalia) were examined from southwestern Asia — YEMEN ARAB REPUBLIC: (El-Hauban, Wadi el-Malak near Ta'izz). A total of 225 specimens (49 females, 52 males, 24 male genitalia, 15 pupal exuviae, 13 larval exuviae, and 72 fourth-instar larvae) were examined from African countries which include ETHIOPIA, KENYA, MALAGASY REPUBLIC, MAURITANIA, MOROCCO (including 3 cotype larvae of *mauritanicus*), SOUTH AFRICA (the type specimens of *simpsoni* and *richteri*), TANZANIA, ZAIRE, ZIMBABWE, and unknown countries.

Culex (Culex) sinaiticus Kirkpatrick

sinaiticus Kirkpatrick, 1924(1925): 383. +Syntypes (male; female):
Kossaima, El Moweilleh, Ain Kadeis, Ain Gedeirat, and Ain Musa,
Sinai, Egypt (DI; ESE).

Culex sinaiticus Kirkpatrick of Salem, 1938: 27 (Sinai, coll.); Lewis, 1945: 16 (Sudan, L distr.); Leeson and Theodor, 1948: 228 (Socotra, A, L keys, coll. sites, L habitat); Senevet et al., 1949: 46, 47 (Egypt [probably Sinai], A, M gen., L); Theodor, 1952: 113 (Middle East, zoogeogr.); Senevet et al., 1957a: 88 (North Africa, L); Margalit and Tahori, 1973: 90-93 (Sinai, distr., L bionomics); Margalit et al., 1973:

32 (Israel, coll. rec., L assoc.).

Culex (Culex) sinaiticus Kirkpatrick of Kirkpatrick, 1925: 122, 191 (Sinai, A, P, L keys, M*, F, P*, L*, bionomics, distr.); Edwards, 1926: 138 (Sinai, A, L keys, A, L, distr.); Stackelberg, 1927: 162 (Sinai, M, F keys, A, M gen.*, distr.); Martini, 1931: 381 (Sinai, A, L keys, M*, F, L*); Edwards, 1941: 311, 420, 482 (P.D.R. Yemen, Sinai, Somalia, Sudan, A key, M*, F, P, distr.); Lewis, 1943a: 282 (Eritrea, coll. rec., L morphol. note, L bionomic note); Lewis, 1943b: 69 (Sudan); Abbott, 1948: 45 (Sudan, L, L habitat, distr.); Hopkins, 1952: 295 (Afrotropical Region, L key, L, bionomics); Knight, 1953a: 216, 230 (Yemen Arab Republic, coll. rec., L, L habitat, distr.); Lewis, 1956: 709 (Sudan, Eritrea, A, coll. sites, distr.); Abdel-Malek, 1956: 100 (Sinai, L bionomics, distr., L key); Mattingly and Knight, 1956: 94-132 (Oman, P.D.R. Yemen, Saudi Arabia, Socotra, Yemen Arab Republic, A, L keys, distr., bionomics); Senevet et al., 1957b: 92 (North Africa, L); Senevet and Andarelli, 1959: 192 (SW Asia, A, P, L keys, M*, F, P, L, distr., bionomics); DuBose and Curtin, 1965: 352, 354 (Mediterranean area east of Suez Canal, A, L keys); Lotfi, 1970: 401 (Iran, coll. rec.); Lotfi, 1973: 206 (Iran, coll. sites); Margalit and Tahori, 1974: 87 (Israel, coll. rec.); Lotfi, 1976: 72, 74, 79 (Iran, L key, ecol. note, L*); Harbach, 1985a: 86, 93, 106 (SW Asia, Egypt, A, L keys).

Adult. A rather small species closely resembling *simpsoni*, but with an incomplete dark dorsal stripe on the distal half or less of the hindfemur, the abdominal sterna largely pale-scaled, and different maxillary palpi and genitalia in the male.

FEMALE. *Head:* Antenna dark, pedicel paler; pedicel and flagellomere 1 with some pale scales on mesal side; length about 1.5 or 1.6 mm. Proboscis dark with indefinite broad area of pale scaling in midregion of ventral surface, sometimes forming more or less complete ring; length about 1.6 or 1.7 mm. Maxillary palpus about 0.2 proboscis length; dark-scaled with pale scales dorsally on palpomere 3 and base and apex of palpomere 4. Falcate scales of vertex coarser than in *simpsoni*, yellowish white; ocular and interocular scales white; forked scales mainly yellowish, paler anteriorly, dark posterolaterally; lateral spatulate scales white. *Thorax* (Fig. 2A): Integument brown. Scutum with pale golden-brown falcate scales, whitish on margins; scutal setae dark brown with reddish and golden tint. Scutellar scales whitish, few on lateral lobes, confined mainly to median lobe. Anteprenotum with large, almost white falcate scales ventrally; postpronotum with similar but slightly yellowish scales, with 4 golden setae on posterodorsal border. Pleural setae golden to golden brown, numbers follow: 4 or 5 upper proepisternal, 6-9 prealar, 3-5 upper mesokatepisternal, 2-6 lower mesokatepisternal, 3-5 upper mesepimeral, and 1 lower mesepimeral. Pleura with broad white spatulate scales as follows: patch ventral and mesal to upper proepisternal setae, patch on anterodorsal border of postspiracular area just behind spiracle, small patch below prealar knob, larger patches at upper corner and on lower posterior border of mesokatepisternum, mesepimeron with anterior patch about same level and size as upper mesokatepisternal patch, and small upper patch before upper mesepimeral setae. *Wing:* Length about 3.0 mm; length of cell R2 2.0-2.3 length of vein R2+3, mean 2.1; length of cell M1/length of cell R2 0.7-0.8; entirely dark-scaled; dorsal scaling: elongate spatulate scales on costa, subcosta, R4+5, mcu, M3+4, CuA and proximal 0.3 of 1A, linear or near linear scales on other veins and distal part of 1A; ventral scaling: elongate spatulate scales on costa, subcosta, R1, R2+3, bases of R2 and R3, M, M1+2, and proximally on M1 and M2, scales absent from R, CuA before mcu and proximal 0.5 of 1A, other veins and distal parts of CuA and 1A with linear or near linear scales. *Halter:* Pedi-

cel and scabellum pale; capitellum dark. *Legs* (hindleg, Fig. 2M): Anterior surface of forecoxa completely white-scaled or with dark scales in middle; mid- and hindcoxae with line of white or slightly yellow scales on anterior side of lateral midline. Femora with distinct white knee spots; fore- and midfemora with anterior dark scaling expanded distally over dorsal surface; forefemur often with narrow anteroventral line of white scales on proximal 0.5; midfemur with nearly complete white anteroventral stripe that terminates before apex, stripe often reduced to narrow line on distal 0.5; hindfemur largely white, with dorsal dark stripe on distal 0.5 or less (usually about 0.4) that abruptly expands over anterior and posterior surfaces on distal 0.1-0.2 (normally about 0.2). Tibiae with conspicuous white anterodorsal spots at apex; anterior and dorsal surfaces of foretibia dark-scaled, posterior and ventral surfaces pale-scaled; midtibia pale-scaled dorsally, dark-scaled ventrally; hindtibia mainly dark-scaled, posteriorly with narrow longitudinal stripe of pale scales not reaching base or apex (about 0.2 from both). Tarsi mainly dark-scaled; posteroventral surface of tarsomere 1, and often 2, with pale scaling. *Abdomen*: Tergum I with median posterior patch of black, black and white or white scales; terga II-VII with white basal bands 0.3-0.4 tergum length, slightly produced laterally, especially on terga VI and VII; tergum VIII almost entirely pale-scaled. Sterna pale-scaled, infrequently with some subtle dark scales on posterolateral corners of sterna VI and VII; sternum VIII with scales on lateral borders only.

MALE. Like female except as follows. *Head*: Antenna shorter, length 1.2-1.5 mm, mean 1.4 mm. Length of maxillary palpus 1.7-1.9 mm, mean 1.8 mm, extending beyond tip of proboscis by length of palpomere 5; palpomere 3 with broad line of white scales on dorsolateral margin not reaching base or apex, also with 3 or 4 long setae and several shorter ones distally beyond pale scaling on ventrolateral margin; palpomere 4 with ventral line of white scales not always reaching apex; palpomere 5 with ventral spot of white scales at base. *Legs*: Anteroventral pale stripe of midfemur poorly developed or absent. *Abdomen*: Sterna usually with some dark scaling on posterior margin or posterolateral corners. *Genitalia* (Fig. 27): Form as figured; phallosome developed as in *simpsoni*. Ninth tergal lobe with 4-7 (mode 5) setae. Gonocoxite unmodified, lateral setae more numerous than in *simpsoni* (about 21 in 4 rows, increasing in length toward base of gonocoxite), apex with conspicuous cluster of about 9 moderately long setae on mesal side of gonostylus; subapical lobe undivided, setae *a-f* similarly developed, rather short, all about same length (*f* the shortest), all flattened and hooked at tip; *g* a rather long, crescentic blade; *h* long and sharply bent distally. Gonostylus rather short and narrow, distinctly flattened distally, rugose dorsally before tip. Phallosome very much as in *simpsoni*, lateral plate with fewer denticles, 3-5 (mode 4) larger denticles project over 7-16 (mode 11) smaller denticles, smaller denticles not as well developed, often reduced to mere bumps. Proctiger and cercal setae as in *simpsoni*.

Pupa (Fig. 27). Form and positions of setae as figured, range and modal number of branches in Table 13; not separable from *simpsoni* unless by the possible distinctions noted below. *Cephalothorax*: As in *antennatus* and *simpsoni*. *Trumpet*: Index 4.0-7.3, mean 5.6; pinna usually longer, 0.2-0.3 length of trumpet. *Abdomen*: Length 2.1-2.6 mm, mean 2.4 mm. Setae 1-III-VI, 5-III-V, and 6-III-VI generally shorter. *Paddle*: Length 0.72-0.82 mm, mean 0.77 mm; width 0.49-0.58 mm, mean 0.54 mm; index 1.3-1.6, mean 1.4.

Larva (Fig. 28). Character and placement of setae as figured, range and modal number of branches in Table 33; resembles *simpsoni* in most respects, differing mainly in characters of the siphon. *Head*: Length 0.61-0.75 mm, mean 0.69 mm; width 1.01-1.18 mm, mean 1.08 mm; lightly tanned, not noticeably darker behind eyes. Dorsomentum usually with 5 teeth (4,5) on either side of median tooth, shape as in

simpsoni. Seta 1-C long, very slender, pale; 5-C single, smaller than in *simpsoni*; 10-C more often double (2-4); 11-C usually double, seldom single; 13-C with 3 or 4 branches, more often with 4. *Antenna*: Length 0.60-0.69 mm, mean 0.63 mm. Seta 1-A with about 25 branches (21-28). *Thorax*: Seta 4-P double, triple or with 4 branches, seldom single. *Abdomen*: Segments III and V with pigmentation giving abdomen a 2-banded appearance similar to *antennatus*. Seta 3-I double or triple, 3-II-IV double (3-II,III seldom single), 3-V,VI single (3-V seldom double), 3-VII with 3 or 4 branches; 1-III usually with 3 or 4 branches (3-5), 1-IV,V with 4 or 5 branches, 1-VI often with 4 branches (2-5). *Segment VIII*: Comb with 32-44 scales, mean 37; anterior scales small and evenly fringed, posterior scales larger with long apical spine. *Siphon*: Index 5.97-8.07, mean 6.97; long, slender, very slightly expanded apically; lightly tanned, slightly darker distally, basal rim dark. Pecten on proximal 0.4, composed of 11-19 (mode 17) spines similar to those in *simpsoni*. Seta 1-S in 4 pairs, first pair occasionally within pecten, individual elements in straight row on posterolateral margin; normally double or triple (see table). *Segment X*: Saddle longer than broad, length 0.33-0.40 mm, mean 0.38 mm, siphon/saddle index 3.35-3.80, mean 3.60. Seta 1,2-X double or triple; 4-X usually in 6 pairs, occasionally in 7, sometimes with 1 seta missing on 1 side.

Systematics. *Culex sinaiticus* is very similar in all stages to *simpsoni*, but is normally distinguishable in the adult and larval stages by the characters given in the keys. The larva also apparently differs consistently in the positions of seta 1-S. The pupae cannot be differentiated at present. The males are easily recognized by the uniquely developed setae of the subapical lobe of the gonocoxite. The latter is probably the most derived feature of the species.

Three larvae from southeastern Iran were available during this study which differ in vague details from typical *sinaiticus*. The comb scales are larger than usual and more closely resemble those of *simpsoni*. These specimens were not examined critically, but I suspect that another species may be involved. The single male from Muscat, Oman, noted by Mattingly and Knight (1956) seems to differ little from specimens collected elsewhere in Arabia.

Culex beta Séguy, 1924 could be a synonym of *sinaiticus*. This nominal form was described from an undisclosed number of larvae collected in Algiers. The partial illustration of the larva published with the original description bears a definite resemblance to *sinaiticus* and I would regard *beta* as a synonym of this species except I have never seen a specimen identified as *beta*. There are no labelled specimens in the alleged type depository (Harbach, 1983) and *sinaiticus* has never been recorded from northern Africa. A thorough survey of the type locality is necessary before it can be decided whether *beta* is a valid species or a synonym of *sinaiticus*.

Bionomics. The immature stages of *sinaiticus* are commonly found in quiet permanent or semipermanent bodies of clean water such as streams, stream pools, springs, wells, and seepages. The breeding sites often contain green algae or higher plants. The species tolerates water with relatively high salt content, but occurs most frequently in fresh water. Associated species of the subgenus *Culex* in southwestern Asia include *bitaeniorhynchus*, *laticinctus*, *mimeticus*, *perexiguus*, *pipiens*, *theileri*, and *tritaeniorhynchus*. The species has also been collected in association with *Anopheles* (*Cellia*) *arabiensis* Patton, *An. (Cel.) dthali* Patton, *An. (Cel.) hispaniola* (Theobald), *An. (Cel.) multicolor* Cambouliu, *An. (Cel.) pharoensis* Theobald, *An. (Cel.) pretoriensis* (Theobald), *An. (Cel.) rhodesiensis* Theobald, *An. (Cel.) sergentii* (Theobald), *An. (Cel.) superpictus* Grassi, *An. (Cel.) turkhudi* Liston, *Culex (Maillotia) arbieeni* Salem, *Cx. (Mal.) deserticola* Kirkpatrick, *Culiseta (Allotheobaldia) longiareolata* (Macquart), and *Uranotaenia (Pseudoficalbia) unguiculata* Edwards. Kirkpatrick (1925) found adults of

sinaiticus in a rest-house and reported that females bite at night. Nothing else is known about the bionomics of the adults, but the species does not appear to be involved in disease transmission.

Distribution. *Culex sinaiticus* is known from the Arabian Peninsula, the Sinai Peninsula of Egypt, Israel, Jordan, Iran, Sudan, Ethiopia, Somalia, and Socotra.

Material examined. 196 specimens. A total of 171 specimens (38 females, 40 males, 19 male genitalia, 12 pupal exuviae, 10 larval exuviae, and 52 fourth-instar larvae) were examined from southwestern Asia — EGYPT (including type specimens): *Sinai Peninsula* (Ain Gedeirat, Ain Musa, Moweilleh, Wadi Feiran, unknown localities); IRAN: (Hajiabad, Sarbaz Zahedan, Shah-Kahoor Zahedan); ISRAEL: (En Avedat, Kadesh Baruea, Neot Hakikar, St. Caltrie, Tel Nagila, unknown localities); JORDAN: (Amman, Aqaba, Wadi Hasa); OMAN: (Muscat); P.D.R. YEMEN: (Harshiyat, Hami, Wadi Ma'adin); SAUDI ARABIA: (Al Hasa); YEMEN ARAB REPUBLIC: (unknown locality). An additional 25 specimens (5 females, 9 males, 7 male genitalia, and 4 fourth-instar larvae) were examined from ETHIOPIA, SOCOTRA, and SUDAN.

Culex (Culex) duttoni Theobald

duttoni Theobald, 1901c: v. +Lectotype female, hereby designated, bearing following data: "Type // *Culex* / *Duttoni* [sic] / (Type) Theobald // C. No II / fr. larvae / 15. 4. 00 / Canoes Creek / Duke Town [Nigeria]" (BM).

dissimilis Theobald, 1901a: 376. +Lectotype male, hereby designated, bearing following data: "Mt. Aureol, / Free Town. / 9. 9. 99. / Bred fr. water / in drain. // Type // Free Town. / Sierra Leone. / VIII. 99. / E.E. Austen. / 99. 267. // *Culex* / *dissimilis* / (Type). Theobald" (BM). Synonymy with *duttoni* by Edwards, 1911: 259.

hirsutipalpis Theobald, 1901a: 378. +Lectotype male, hereby designated, bearing following data: "Type / SALISBURY / Mashonaland [Rhodesia] / Feb. 1900 / G.A.K. Marshall / 79 / *Culex* / *hirsutipalpis* / (Type) Theobald." (BM). Synonymy with *duttoni* by Edwards, 1911: 259.

anarmostus Theobald, 1903a: 170. +Holotype female: Freetown, Sierra Leone (BM). Synonymy with *duttoni* by Edwards, 1911: 259.

bifoliata Theobald, 1905c: 31. +Lectotype male, hereby designated, bearing following data: "Type // *Culex* / *bifoliata*. / Type. F.V.T. // Transvaal / Dr. Simpson // 54~ // Recd. from / F.V. Theobald, / 1907-29." (BM). Synonymy with *duttoni* by Edwards, 1941: 300.

condylodesmus Grünberg, 1905: 385. Syntypes (male; female): Victoria, Kamerum, [Nigeria] (ZM). Synonymy with *duttoni* by Edwards, 1911: 259.

albovirgatus Graham, 1910: 264. +Lectotype male, hereby designated, bearing following data: "Yaba / 26-5-09 / from larva in / a fetish pot / WMG // Type // Yaba, / Lagos, / W. Africa. [Nigeria] / 26. V. 1909. / Dr. W.M. Graham. / 1910-80." (BM). Synonymy with *duttoni* by Edwards, 1911: 259.

Culex dissimilis Theobald of Wesche, 1910: 40 (W. Africa, P, L keys, P*, L*).

Culex duttoni Theobald of Wesche, 1910: 34 (W. Africa, P, L keys, P*, L*); Lewis, 1945:

15 (Sudan, distr.).

Culex (Culex) duttoni Theobald of Edwards, 1941: 300, 418, 482 (Afrotropical Region, A key, M*, F*, P*, syn., distr.); Lewis, 1943a: 281 (Eritrea, coll. rec., L bionomic note); Lewis, 1943b: 69, 72 (Sudan, L habitat, bionomic note); Abbott, 1948: 45 (Sudan, distr.); Hopkins, 1952: 287 (Afrotropical Region, L key, L*, bionomics); Lewis, 1956: 707 (Sudan, Eritrea, coll. sites); Mattingly and Knight, 1956: 94-135 (P.D.R. Yemen, A, L keys, distr. bionomics); Ovazza et al., 1956: 168 (Ethiopia, coll. sites); Mekuria, 1968: 78 (Ethiopia, distr., rec.); Harbach, 1985a: 86, 92, 102 (SW Asia, distr., A, L keys).

Adult. A rather large species easily distinguished from all other species of *Culex* known to occur in southwestern Asia by the presence of an indefinitely ringed proboscis, ringed tarsi, postspiracular scales, an anterior white stripe on the midtibia, and usually 2 to 4 lower mesepimeral setae.

FEMALE. *Head:* Antenna dark, length about 2.4 mm; pedicel pale laterally, mesal surface usually with some pale scales; flagellum normal, most whorls with 5 or 6 setae. Proboscis black-scaled at base and apex, middle with ring of whitish scales beginning 0.2-0.4 from base and extending to point about 0.7 from base, proximal boundary of ring ill-defined, distal boundary sharply defined, ring sometimes incomplete or nearly so on dorsal surface; length about 2.2 mm. Maxillary palpus mainly black-scaled, palpomere 4 with dorsomesal stripe of white scales; length about 0.5 mm, about 0.2 length of proboscis. Forked scales of vertex mainly pale, darker laterally; falcate scales mainly pale, usually yellowish white in middle, somewhat brownish laterally and white along margins of compound eyes; lateral spatulate scales white, often dark posteriorly and in middle of lateral surface. *Thorax:* Pleural integument brown, paler on middle of mesokatepisternum and posterior area of mesepisternum, pale areas and scale-patches separate dark areas to give pleura a spotted appearance; scutal integument dark brown. Scutum with fine, rather densely matted falcate scales, scales mainly golden brown to brown but with an indefinite and irregular mottling of pale yellow to golden scales, usually with whitish scales on anterior and lateral margins, prescutellar area and forming indefinite middorsal pair of submedial spots; scutal setae prominent only on supraalar area. Scutellar scales same as prescutellar scales; lateral lobes each usually with 4 or 5 large setae, median lobe normally with 8 large setae. Anteprenotum with upper and lower patches of falcate scales, upper patch golden to golden brown, lower patch paler, usually whitish. Postpronotum mainly with golden-brown scales, scales usually whitish posteriorly; with 6-9 dark setae in posterodorsal row, often paler posteriorly. Pleural setae golden to golden brown: 5-9 upper proepisternal, 12-14 prealar, 5 upper mesokatepisternal, 5-7 lower mesokatepisternal, 6-12 upper mesepimeral and 1-4 (usually 2; often 3) lower mesepimeral. Pleural scales white, anterior part of postspiracular area with falcate scales, other areas with narrow spatulate scales as follows: few below upper proepisternal scales, upper and lower patches on mesokatepisternum and anterior and upper patches on mesepimeron. *Wing:* Length 4.2-4.5 mm, mean 4.4 mm; length of cell R2/length of vein R2+3 3.0-3.9, mean 3.4; subcosta intersects costa just before furcation of R2+3; length of cell M1/length of cell R2 slightly more than 0.8; dark-scaled with line of pale scales on posterior margin of costa at base. Dorsal scaling: narrow spatulate scales on costa, subcosta, R and R1; very narrow spatulate scales on R4+5, M1, M2, mcu, M3+4, CuA and approximately proximal 0.5 of 1A; linear scales on Rs, R2+3, R2, R3, M, M1+2 and distally on 1A. Ventral scaling: narrow spatulate scales on costa, subcosta, Rs, R1+2, M, M1+2, CuA proximal of mcu and proximal 0.5 of 1A; linear scales on R, R1, R2, R3, R4+5, mcu, M3+4 and CuA

beyond mcu. *Halter*: Entirely pale. *Legs* (midleg, Fig. 2H): Mainly with dark brown to black scales. Anterior surface of forecoxa mainly dark-scaled, with basal and distal patches of white scales; anterolateral margin of midcoxa with longitudinal stripe of white scales margined anteriorly by longitudinal stripe of dark scales, white stripe broadest at base, dark stripe broadest at apex; integument of hindcoxa nearly colorless, lateral surface with longitudinal stripe of white scales and small spot of dark scales at apex. Trochanters mainly with white scales, anteroventral surface of fore- and midtrochanters usually with some dark scales. Femora each narrowly pale at base and with indistinct narrow pale knee spot; forefemur with narrow anteroventral line of pale scales on proximal 0.5, posterior surface with posterodorsal pale stripe and more or less distinct narrow median line of pale scales; posterior surface of mid- and hindfemora pale-scaled except on distal 0.3 or less. Tibiae each with narrow white ring at base; posterior surface of foretibia with complete white stripe; midtibia with narrow white anterodorsal and broader posterior white stripes; hindtibia with incomplete posterior pale stripe. Tarsi with narrow white rings across joints, rings may be indistinct or absent between tarsomeres 4 and 5; tarsomere 1 of each leg with narrow basal white ring, tarsomere 1 of fore- and midlegs with pale scales on posterior surface, hindtarsomere 1 with pale scales on ventral surface. Pulvilli distinct, white. Ungues dark, small, simple. *Abdomen*: Tergum I with median posterior patch of black scales; terga II-VIII mainly dark brown- to black-scaled, tergum II with small basomedian triangular patch of cream-colored scales, terga III-VIII with narrow, convex, cream-colored bands 0.20-0.35 tergum length and elongate basolateral white patches which become longer on more posterior terga, bands and spots not connected on anterior terga, narrowly if at all connected on terga V-VIII, band usually present and continuous with spots on tergum VIII. Sterna II-VII mainly with cream-colored scales, with black scales on posterior corners; sternum VIII with lateral patches of cream-colored scales, broad median area without scales.

MALE. Like female except as follows. *Head*: Antenna strongly plumose, pale between flagellar whorls; length about 1.8 mm. Proboscis with narrow pale ring 0.55-0.70 from base; false joint about 0.65 from base; length 2.3-2.9 mm, mean 2.5 mm. Length of maxillary palpus 3.1-3.4 mm, mean 3.3 mm, extending beyond tip of proboscis by more than length of palpomere 5; palpus mainly black-scaled, integument between palpomeres 2 and 3 pale; palpomere 3 white-scaled in middle, ventromesal margin at apex with few white scales, ventral surface without scales, with ventrolateral row of about 20 long black setae on distal 0.5 and complete or nearly complete ventromesal row of short antorsely curved setae; palpomeres 4 and 5 with small dorsal and ventral patches of white scales at base, ventral surface of palpomere 4 also with some white scales just beyond middle, palpomere 5 also with dorsomesal line of white scales on distal 0.4-0.5; lateral and mesal surfaces of palpomeres 4 and 5 densely setose. *Thorax*: Upper proepisternal setae more numerous, 16-26. *Wing*: Length 3.8-4.0 mm, mean 3.9 mm; length of cell R2/length of vein R2+3 1.8-2.4, mean 2.1; subcosta intersects costa well before furcation of R2+3. *Abdomen*: Terga without basolateral patches of white scales, basal pale bands normally 0.35-0.45 tergum length; tergum II with basomedian triangular pale patch or narrow basal pale band produced posteriorly in middle; basal bands of terga III-VII usually straight, sometimes slightly produced posteriorly in middle on terga V-VII, bands of terga V-VII and occasionally IV produced posteriorly along lateral scale-free areas, particularly on terga VI and VII; tergum VIII (ventral in position) with broad concave basal whitish band. Sternum VIII (dorsal in position) variable, similar to tergum VII but basal band sometimes obsolescent in middle or produced medially to posterior border. *Genitalia* (Fig. 29): Ninth tergal lobe poorly developed, with 3-8 (mode 6) rather widely spaced setae. Gonocoxite rather long

and slender, mesal and ventral setae developed as usual, lateral setae in 3 or 4 longitudinal rows, these shorter in each row toward large ventral setae; subapical lobe indistinctly divided, setae *a-c* equally developed, long and tapered with hooked tips; *d-e* slender with hooked tips, *f* flattened with hooked tip; *g* more or less symmetrical, rather narrow, rounded apically, borne on distinct prominence; *h* straight or bent apically, tapered with narrow pointed distal part. Gonostylus normal; gonostylar claw flat, slightly broader distally. Phallosome as broad as long with lateral plate and aedeagal sclerite nearly completely fused into a single simple sclerite, crest of aedeagal sclerite not distinguished, dorsal arm of lateral plate absent, ventral arm a long slender dorsally directed and laterally bent sickle-shaped process. Proctiger slightly elongated; paraproct long and slender, without basal lateral arm, crown of spinelike spicules grading into short blades and series of bumps laterally. Cercal sclerite with ribbonlike caudolateral extension joining paraproct near base of crown; 3-6 (mode 4) cercal setae. Tergum X developed as usual.

Pupa (Fig. 29). Not definitely associated with adults; form and placement of setae as figured, range and modal number of branches in Table 14; immediately distinguished from all other species of *Culex* in the region by the vesiculation of the scutum, metanotum, and first two abdominal terga. *Cephalothorax*: Lightly tanned, scutum and metathorax moderately tanned; middle of scutum behind trumpets and metanotum covered with distinct vesicles. Setae 1,2,8,9-CT frequently double, sometimes triple; 3,4,6,11,12-CT often triple (2-5); 7-CT double. *Trumpet*: Lightly to moderately tanned, tracheoid area darker; relatively short and flared, index 3.3-4.5, mean 3.8; pinna with distinct shallow rounded emargination at tip. *Abdomen*: Lightly tanned, terga I-IV darker medially; middle of terga I and II and intersegmental membrane between terga II-III and III-IV with conspicuous vesicles. Seta 6-I,II short as in *laticinctus* and *mattinglyi*; 7-I,II usually with 3 or 4 branches, 7-I occasionally double or with 5 branches; 9-II frequently anterior to 7-II; 1-III,IV most often with 4 or 5 branches (see table), 1-V-VII variable (see table) but usually double or triple, more often double; 5-IV usually multiple (1-4) and about length of following tergum, very different in appearance from 5-V,VI which are usually single and much longer than following tergum; 6-III-V normally single, seldom double (6-V triple on 1 side in 1 specimen examined), 6-VI most often triple (1-3). *Genital lobe*: Lightly tanned; length 0.2-0.3 mm in female, about 0.4 mm in male. *Paddle*: Very lightly tanned, buttress and midrib darker; midrib with obvious curvature, inner part not as broad as outer part; length 0.98-1.16 mm, mean 1.07 mm, width 0.72-1.02 mm, mean 0.88 mm, index 1.1-1.4, mean 1.2. Seta 1-P usually double, sometimes single; 2-P almost always absent (double on 1 paddle in 1 specimen examined).

Larva (Fig. 30). Not definitely associated with adults; positions and attributes of setae as figured, range and modal number of branches in Table 34; easily recognized by the unusual siphon. *Head*: Length 0.87-1.07 mm, mean 0.95 mm; width 1.14-1.54 mm, mean 1.35 mm; moderately tanned, darker posteriorly. Labiogula very nearly parallel-sided; hypostomal suture rather poorly indicated but complete, extended to collar from posterior tentorial pit. Dorsomentum more strongly produced anteriorly in middle than usual; with 12-15 teeth on each side of median tooth, teeth progressively larger toward sides. Seta 1-C long, slender, tapered, and tanned; 2-C absent; 5,6-C usually with 7 or 8 branches (see table); 7-C usually with 8 or 9 branches (7-11); 8-C normally double, seldom single; 9-C variable (1-6); 10-C forked, usually bifurcate, infrequently trifurcate. *Antenna*: Length 0.53-0.57 mm, mean 0.55 mm; lightly to moderately tanned, distal part and basal rim darker. Seta 1-A with about 23 aciculate branches (18-26); 2,3,4-A of equal length, distinctly aciculate. *Thorax*: Integument

hyaline; rather sparsely covered with fine spicules. Seta 4-P double or triple; 7-P double; 8-P most often with 4 branches (3-6). Seta 1-M single; 2-M variable (1-4); 6,7-M on common tubercle. Seta 1-T very small, usually double (1-3); 2-T long, single. *Abdomen*: Integument hyaline; smooth. Seta 3-I-VII single, 3-VII sometimes double; 6-I usually double, infrequently triple, 6-II not as strong as 6-I, with 2-4 branches occurring in nearly equal frequencies; 7-I most often triple (2-5), nearly as long as 6-I, 7-II more strongly developed than in other species, resembling 7-I but shorter, with 3 or 4 branches; 5-III-VII and 6-III-VI long and single, 5-III-VI distinctly longer than 2 abdominal segments; 13-III-V normally double (see table). *Segment VIII*: Comb with 25-44 (mode 42) rather short fringed scales. Setae 1,5-VIII distinctly shorter than 2,4-VIII, most often with 5 or 6 branches. *Siphon*: Index 3.37-4.24, mean 3.70; strongly inflated, narrowed distally, with short spine anteriorly near apex; moderately tanned, with dark subapical band, basal rim heavily tanned. Pecten reduced, beginning well above base of siphon, composed of 3-5 (Hopkins, 1952 reported 3-6) slender spines with ventral row of short denticles. Seta 1-S in 4 or 5 pairs, usually 4, 1c-S often absent; 1a,b,c,d-S long and single (1d-S double on 1 side in 1 specimen examined), 1e-S usually triple (1-4); 1a-S within pecten, 1d-S either within or below dark band, 1e-S within band. *Segment X*: Relatively small; saddle complete, length 0.44-0.51 mm, mean 0.48 mm, siphon/saddle index 3.76-4.63, mean 4.09. Seta 1-X long and single; 2-X single; 4-X in 6 pairs. Anal papillae stout, about twice length of saddle, ventral pair shorter than dorsal pair.

Systematics. *Culex duttoni* is a bizarre species which combines features of the *pipiens* and *sitiens* groups and is recognized here as the name-bearing member of a separate group. The group also includes the closely related *Culex watti* Edwards, 1920. These are rather large species which are characterized by the indefinitely ringed proboscis, ringed tarsi, and the usual presence of two to four lower mesepimeral setae in the adult. The male genitalia are distinctive: the lateral plate is a simple sclerite without a dorsal arm, the ventral arm is enormously developed, yet reminiscent of the type found in the *pipiens* and *trifilatus* subgroups; and the paraproct has no trace of a basal lateral arm. The larva resembles members of the *pipiens* group in most respects, but setae 1-C and 3-P and the pecten spines approach the condition in the *sitiens* group and setae 8-P, 7-II, and 1-S are uniquely developed. The distinct form of the larval siphon is suggestive of that in *Culex hutchinsoni* Barraud, 1924b of the Oriental Region. The larva of *watti* has never been described, but is said to be indistinguishable from *duttoni* (Hopkins, 1952). The pupal stage seems to differ from most members of the *pipiens* and *sitiens* groups in having seta 7-I,II usually with 3 or 4 branches, setae 6-III-V and 5-V,VI usually single, 1-P usually double, and 2-P normally absent. The pupa of *watti* is unknown.

The association of the immature stages with the adults of this species is presumptive only. No individual rearings are available, but the association seems correct. It is based on the sympatric occurrence of larvae and adults in the P.D.R. Yemen and associated larval and pupal exuviae from Ghana. There is a possibility, however, that the unknown larva and pupa of *watti* were mixed in the material examined.

Bionomics. *Culex duttoni* is a semidomestic species which uses a wide variety of breeding places. It has been found in pools in streams, ground pools (including puddles), and a variety of artificial containers, including drums, pots, sunken barrels, boats, and wells. It is possible that the dispersal of this species to the Arabian Peninsula was accomplished by man. The occurrence of this species in southwestern Asia is based on two larvae and two adults from the P.D.R. Yemen. The adults were captured in a cave. According to Lewis (1943b), females are never seen biting man. *Culex duttoni* is probably not a medically important species.

Distribution. *Culex duttoni* is widely distributed in the Afrotropical Region. It has been recorded and described from a single larva collected in the south of Morocco (Bailly-Choumara, 1968).

Material examined. 85 specimens. Only 5 specimens (1 female, 1 male, 1 male genitalia, and 2 fourth-instar larvae) were examined from southwestern Asia — P.D.R. YEMEN: (Mikhuras, Wadi Gheil el Khumeira). A total of 80 specimens (36 females, 22 males, 5 male genitalia, 9 pupal exuviae, 4 larval exuviae, and 4 fourth-instar larvae) were examined from ANGOLA, BENIN, CAMEROON, ETHIOPIA, GHANA, KENYA, MALAWI, NIGERIA (including the type specimens of *duttoni* and *albovirgatus*), SENEGAL, SIERRA LEONE (the type specimens of *dissimilis* and *anarmostus*), SOUTH AFRICA (the lectotype male of *bifoliata*), SUDAN, TANZANIA, UGANDA, ZIMBABWE (the type specimens of *hirsutipalpis*), and unknown localities.

Culex (Culex) sitiens Wiedemann

sitiens Wiedemann, 1828: 542. Holotype female: Sumatra, Indonesia (ZMC).

microannulatus Theobald, 1901a: 353. +Lectotype male: Quilon, Travancore, [Madras State], India (BM), designated by Bram, 1967a: 243. Synonymy with *sitiens* by Edwards, 1913c: 232.

somaliensis Neveu-Lemaire, 1906: 254. Syntypes (male; female): Djibouti, Djibouti (non-extant?). Synonymy with *sitiens* by Edwards, 1913c: 232.

salus Theobald, 1908b: 256. +Lectotype male, hereby designated, mounted on two slides (see Harbach, 1983: 104) bearing following data: Slide 1 (with maxillary palpi, proboscis, and part of head capsule) — "The / Salt Water. / Mosquito. / TYPE // Culex / salus. / Theobald / Port Sudan // Recd. from F.V. Theobald. / 1910-396"; Slide 2 (with genitalia) — "Salt water / mosquito. / TYPE // Culex / salus / Theobald / Port Sudan. // Recd. fr[om] / F.V. Theo[bald] / 1910-395." (BM). Synonymy with *somaliensis* by Edwards, 1911: 261.

For complete synonymy, see Appendix D.

Culex annulus Theobald of Becker, 1907(1910): 140 (Socotra, A).

Culex impellens Walker of Giles, 1901a: 606 (India, A*, L*, distr.); Theobald, 1901a: 362 (India, F*); Christophers, 1906: 8 (? India, L*).

Culex sitiens Wiedemann of Edwards, 1913c: 232 (Oriental Region, syn., tax., A); Edwards, 1922: 277, Pl. VI (Oriental Region, A key, M gen.*); Barraud, 1924a: 993 (India, A key, syn., M*, F, distr.); Barraud, 1924c: 427 (India, L*); Lewis, 1945: 15 (Sudan, L, distr.); Leeson and Theodor, 1948: 227 (Socotra, A, L keys, L, L bionomics, coll. sites).

Culex (Culex) sitiens Wiedemann of Barraud, 1934: 398 (India, A, L keys, M*, F, L*, L habitat, distr., syn.); Edwards, 1941: 296, 417, 482 (Afrotropical Region, A key, M*, F, P, syn., distr.); Hopkins, 1952: 284 (Afrotropical Region, L key, L bionomics); Knight, 1953a: 231 (Yemen Arab Republic, A, L, distr., L habitat); Lewis, 1956: 707 (Sudan, L, coll. rec., distr.); Mattingly and Knight, 1956: 103-137 (Arabian Peninsula, L*, A, L keys, distr., bionomics); Ovazza et al., 1956: 167 (Ethiopia, M gen.*); Lotfi, 1970: 401 (Iran, coll. rec.); Aslamkhan, 1971: 155

(Pakistan); Lotfi, 1973: 206 (Iran, coll. rec.); Lotfi, 1976: 72, 75, 81 (Iran, L key, ecol. note, L*); Sirivanakarn, 1976: 95 (Oriental Region, A, P, L keys, M*, F*, P*, L*, tax., distr., bionomics); Harbach, 1985a: 86, 97, 102 (SW Asia, distr., A, L keys).

Culex somaliensis Neveu-Lemaire of Edwards, 1911: 261 (Africa, A, key); Edwards, 1912c: 28 (Africa, A key).

Culex thalassius Theobald of Leeson and Theodor, 1948: 228 (in part; Socotra, L key).

Adult. A medium-sized species distinguished from all other *Culex* occurring in southwestern Asia by having speckled femora and base of cell R2 distal to base of cell M1.

FEMALE. *Head:* Antenna blackish; pedicel yellow, mesal surface dark brown to black with tiny setae and scales; length 1.7-2.2 mm, mean 1.9 mm. Proboscis dark, with distinct median whitish ring about 0.2 proboscis length, extending from 0.4 to 0.6 from base; frequently with scattered pale scales proximal to ring, particularly ventrally; sometimes also with scattered pale scales faintly evident distal to ring; with indefinite narrow pale fringe of scales at apex of prementum; length 1.8-2.1 mm, mean 1.9 mm. Maxillary palpus dark with pale scales laterally at apex, sometimes also with pale scales laterally at base or on entire lateral surface; palpomeres 2 and 3 with 3-5 long lateral setae; length about 0.6 mm, approximately 0.3 proboscis length. Forked scales of vertex pale yellow to yellowish brown, darker posterolaterally; falcate scales pale yellow to brownish, darker laterally; interocular scales yellowish white and projecting ventrally between eyes; lateral spatulate scales yellowish white. *Thorax:* Integument dark brown to black. Scutum mottled with variable spots and blotches of coarse dark and pale scales; dark brown to golden-brown scales usually predominant with pale yellow to golden scales on anterior and lateral margins, across middle and on prescutellar area; acrostichal and dorsocentral setae short, slender and indistinct; supraalar setae robust and dense. Scutellum with rather numerous pale yellow falcate scales; lateral lobes each with 4 or 5 strongly developed setae, 6-9 weaker ones; median lobe with 5-8 large setae, 9-12 smaller ones. Antepronotum with coarse yellowish falcate scales, often with some brownish ones in middle; postpronotum with dark brown or golden-brown scales in middle, pale yellow scales anteriorly and posteriorly, posterior scales coarser. Proepisternum with elongate subfusiform scales laterally below upper proepisternal setae; shorter apically rounded pale yellow spatulate scales among and extending mesal to setae. Mesopleuron with white spatulate scales: distinct upper and lower patches on katepisternum, distinct anterior patch on anepimeron, and few scales usually present among upper mesepimeral setae. Numbers of pleural setae: 6-8 upper proepisternal, 9-17 prealar, 4-8 upper mesokatepisternal, 5-10 lower mesokatepisternal, 7-12 upper mesepimeral, no lower mesepimeral. *Wing:* Length 3.2-4.0 mm, mean 3.7 mm; length of cell R2 2.1-2.5 length of vein R2+3, mean 2.3; length of cell M1/length of cell R2 about 0.9; furcation of vein R2+3 normally distal to furcation of vein M1+2; mainly dark-scaled, with pale spatulate scales along posterior margin of costa (except at apex), posterior margin of approximately distal 0.5 of subcosta, and anterior margin of R1; usually with small spot of pale scales at base of remigium. *Halter:* Pedicel and scabellum pale; capitellum dark, with white scales. *Legs:* Anterior surface of forecoxa white-scaled, with few pale scales posterolaterally at apex; midcoxa with broad longitudinal patch of white scales on anterior side of lateral midline, extending onto anterior surface distally; hindcoxa with slightly curved lateral longitudinal line of pale scales. Trochanters with white spatulate scales on ventral and posterior surfaces; mid- and hindtrochanters also with white scales on dorsal surface. Femora with whitish knee spots; anterior surface of

forefemur predominantly dark-scaled with more or less definite whitish stripe on proximal 0.5, distal 0.5 speckled with pale scales, posterior surface whitish-scaled; anterior surface of midfemur dark-scaled except at base, speckled with pale scales, posterior surface whitish-scaled; hindfemur primarily whitish-scaled, with narrow band of dark scales at apex, sometimes with indistinct dorsal dark stripe extending proximad from band, frequently with scattered dark scales on anterior surface. Dorsal surface of foretibia dark-scaled with indistinct spot of pale scales at apex, pale-scaled ventrally; anteroventral surface of midtibia with dark scales confluent with patch of dark scales on 0.25 to 0.50 of dorsal surface except at extreme base, with spot of pale scales dorsally at apex; hindtibia mainly dark-scaled dorsally, with dark scales dissipated in middle and extended over sides at ends, with anterodorsal spot of pale scales at apex. Tarsi mainly dark-scaled; tarsomere 1 pale-scaled ventrally; joints with narrow whitish rings mainly on bases of tarsomeres, rings distinct between tarsomeres 1-2 and 2-3, often indistinct between 3-4 and 4-5, tarsomere 1 with narrow pale ring at base; hindtarsomere 2 faintly pale beneath. *Abdomen*: Tergum I with median posterior patch of scales, scales usually dark anteriorly and pale posteriorly; terga II-VIII with basal white bands continuous with elongate basolateral spots of same color, band of tergum II produced in middle, others of even width (0.2-0.4 length of tergum); terga II-VIII also with very narrow white bands on posterior margin, that of tergum VII often strongly produced in middle and occasionally united with basal band. Sternum I bare; sternum II usually somewhat sparsely clothed in white scales, particularly on median and lateral areas; sterna III-VII white-scaled with posterolateral dark spots, median area of posterior margin with yellowish scales; sternum VIII with lateral patches of white scales, median area void of scales.

MALE. Like female except as follows. *Head*: Proboscis with ventral cluster of setae at base of pale ring; false joint about 0.55 from base of proboscis. Length of maxillary palpus about 2.1-2.8 mm, mean 2.6 mm, extending beyond tip of proboscis by length of palpomere 5; integument of palpomere 2 pale apically, with pale scales on dorsal and lateral surfaces; palpomere 3 with broad median pale ring comprised of whitish scales on dorsal and lateral surfaces and pale bare integument on ventral and mesal surfaces, ventromesal margin with row of about 25 short apically curved and flattened setae on distal 0.8, ventrolateral margin beyond median pale ring with about 15 long setae; palpomeres 4 and 5 with basal pale rings, densely setose; palpomere 5 with apical 0.5 or less (usually 0.33) pale-scaled. *Thorax*: Upper proepisternal setae more numerous, 9-12. *Wing*: Pale scales usually absent at base of remigium. *Abdomen*: Terga without basolateral pale spots; basal bands of terga V-VII produced posteriorly along lateral scale-free areas; tergum VII (and occasionally VI) with large triangular posteromedian pale spot, spot often connected medially to basal band; tergum VIII (ventral in position) with broad basal pale band. Sterna I and II same as in female; sterna III-VII with narrow posterior band of white scales, rather broad subapical dark band and broad basal pale band, dark band of more posterior sterna often divided in middle by narrow longitudinal line of pale scales connecting basal and apical bands; sternum VIII (dorsal in position) like tergum VII. *Genitalia* (Fig. 31). Ninth tergal lobe poorly developed, narrowly connected with its mate of the opposite side, with line of 2-10 (mode 6) short setae. Gonocoxite normal, lateral area with 3 or 4 rows of moderately developed setae extending from above base to point just above subapical lobe; subapical lobe undivided, setae *a-c* rodlike as usual, *a* shorter than *b* and *c* and blunt at tip, *b* and *c* hooked at tip; setae *d-e* with small barblike denticle before recurved tip, *f* hooked at tip; seta *g* a simple, symmetrical, apically rounded leaf; *h* about length of *g*, flattened, bent distally. Gonostylus rather stout basally, distinctly tapered apically, slightly rugose dorsally before tip; gonostylar claw short, broadened apically, troughlike.

Phallosome not much longer than broad, aedeagal sclerite shorter than lateral plate; lateral plate with definite inner and outer divisions, inner division (= ventral arm) a broad minutely spiculate lobe borne on ventromesal margin of outer division (= lateral arm), ventrocaudal angle rounded, dorsocaudal angle rather pointed, dorsal margin with 3 prominent caudally directed teeth before apex; outer division rather simple, posteromesal margin with a conspicuous laterally curved tooth which appears broad in lateral view, ventrocaudal angle giving rise to a heavy flattened laterally directed and dorsally curved pointed process, dorsal process a prominent dorsolaterally projecting earlike lobe; dorsal arm absent (unless represented by the posteromesal tooth of the outer division). Proctiger unmodified; paraproct with moderately long, gently curved basal lateral arm and distinct ventral acetabulum. Cercal sclerite more or less rectangular; 2-5 (mode 3) cercal setae present. Tergum X developed as usual.

Pupa (Fig. 31). Character and positions of setae as figured, range and modal number of branches in Table 15; without obvious distinctive features, most closely resembling *mimeticus* from which it can usually be separated by the larger number of branches of setae 1-II, 6-III-VI, and 9-VIII. *Cephalothorax*: Lightly tanned, legs and metathorax darker. Setae 1-9,11,12-CT usually double or triple (see table); 1-CT longer and slightly stronger than 2,3-CT; 10-CT frequently with 7 or 8 branches (5-9), distinctly longer than 11,12-CT. *Trumpet*: Moderately tanned, tracheoid area only slightly darker; index 4.1-5.7, mean 4.7; pinna long, 0.3-0.4 trumpet length. *Abdomen*: Lightly tanned, anterior terga darker; length 3.1-3.7 mm, mean 3.5 mm. Seta 7-I triple, 7-II double or triple, more often double; 1-II with 4-10 aciculate branches; 1-III-VI moderately developed, with fewer branches on each successive posterior tergum, 1-III usually with 5 or 6 branches (5-8), 1-IV normally with 4 or 5 branches (3-5), 1-V with 3 or 4 branches, 1-VI double or triple; 6-III-VI single or double, more often double, 6-V,VI larger than 6-III,IV; 5-IV-VI equally developed, usually double, longer than following tergum; 9-VIII commonly with 10-12 branches (9-14). *Genital lobe*: Lightly tanned; length about 0.20 mm in female, about 0.35 mm in male. *Paddle*: Lightly tanned, buttress and midrib darker; length 0.90-1.00 mm, mean 0.94 mm, width 0.68-0.80 mm, mean 0.74 mm, index about 1.3.

Larva (Fig. 32). Form and placement of setae as figured, range and modal number of branches in Table 35; bearing a strong resemblance to *theileri*, *laticinctus*, and *mattinglyi* but immediately distinguished by the form of seta 1-C and the pecten spines. *Head*: Length 0.72-0.88 mm, mean 0.80 mm; width 1.13-1.35 mm, mean 1.24 mm; lightly tanned, labiogula and posterior areas of lateralia and dorsal apotome darker. Hypostomal suture strongly indicated, diverging posteriorly from its mate of the opposite side, ending about halfway between posterior tentorial pit and collar. Dorsomentum with 7 or 8 teeth on either side of center. Seta 1-C short, thick, usually spiculate at sides, dark; 2-C present or absent; 5-C usually with 6 or 7 branches (6-8); 6-C often with 4, 5 or 6 branches (4-7); 7-C frequently with 9 or 10 branches (7-11); 10,11,12,15-C double or triple, 10,11-C occasionally with 4 branches; 13-C normally double (1-3). *Antenna*: Length 0.41-0.56 mm, mean 0.49 mm; lightly tanned, distal part darker, with dark ring at base; proximal part with aciculae on dorsal and lateral surfaces, distal part with few spicules laterally. Seta 1-A with about 27 branches (22-32); 2,3-A subapical. *Thorax*: Integument hyaline, smooth. Seta 4-P double; 7-P double or triple; 8-P single or double, distinctly shorter than 4,7-P. Seta 1-M single, about twice length of 2-M; 4-M single or double. Seta 1-T single, nearly as long as 2-T which is usually single, sometimes double; 13-T distinctly longer than 12-T, with 2-5 branches. *Abdomen*:

Integument like that of thorax. Seta 3-I usually single, seldom double, 3-II-VI single, 3-VII usually double (1-4); 6-I,II usually triple (2-4), 6-III-VI normally double; 7-I usually long and single, about as long as 6-I, seldom double; 1-III-VII rather short, about 0.5 length of segment, double or triple, more often double; 13-III-V, VII developed like 1-III-VII, usually double (see table). *Segment VIII*: Comb with 30-54 (mean 42) rather short, fringed scales. *Siphon*: Index 3.61-4.55, mean 3.80; lightly tanned, basal ring and acus darker. Pecten composed of 9-17 (mode 13) spines with complete ventral row of denticles, larger spines with 7-13 (mode 10) denticles, tendency for most basal spines to fuse. Seta 1-S in 6, 6.5 or 7 pairs, 1 distal pair (1e-S) borne laterally, others imperfectly paired near posterior midline, proximal 3 or 4 pairs often with 6 or 7 branches and about twice as long as diameter of siphon at point of attachment. *Segment X*: Saddle complete; lightly tanned; posterodorsal margin with distinct short spicules; length 0.29-0.35 mm, mean 0.33 mm, siphon/saddle index 3.03-4.29, mean 3.71. Seta 1-X single; 2-X usually with 4 or 5 branches, occasionally triple; 4-X usually in 6 pairs. Anal papillae short, globose.

Systematics. *Culex sitiens* is the nominotypical member of a large and variable group of species which probably should be divided into several different groups. The group is widespread in the warmer parts of the Old World with species occurring in the Afrotropical, Oriental, and Australian regions, and the Mediterranean and Manchurian subregions of the Palaearctic. The group is currently subdivided into six subgroups (Sirivanakarn, 1976). Six members belonging to the *sitiens*, *mimeticus*, *bitaeniorhynchus*, and *vishnui* subgroups occur in southwestern Asia. The *sitiens* subgroup is represented by *sitiens* and *poicilipes*.

Culex sitiens is a highly variable species which breeds in brackish coastal waters from East Africa to the South Pacific. It is very likely that this nominal form is actually composed of several distinct species. There is considerable variation in all stages and there seems to be many isolated populations. Adults from southwestern Asia have much lighter scutal scales and more extensive pale scaling on the wings than specimens from the Oriental Region. There is an extreme range of variation in larval characters, especially in the size and shape of seta 1-C and the siphon, but there are no apparent differences in the form of the male genitalia.

There should be no difficulty in identifying specimens of *sitiens* in southwestern Asia unless the very similar *Culex thalassius* Theobald, 1903a also occurs in the Afrotropical part of the Arabian Peninsula. Adults of this species differ in having darker scutal scales and no speckling of pale scales on the femora. The male genitalia differ slightly in details of the phallosome. The larva of *thalassius* at present cannot be distinguished with certainty from that of *sitiens*. The record of *thalassius* from Syria (Abdel-Malek, 1960) cannot be correct, and probably is based on misidentified larvae of *tritaeniorhynchus*.

Bionomics. *Culex sitiens* breeds primarily in coastal brackish ground pools, mangrove swamps, and salt marshes, but is also found in artificial containers and collections of fresh water not far from the seacoast. Specimens from the Yemen Arab Republic have been collected in open cement basins some distance inland and in brackish water seepage pools near the seashore (Knight, 1953a). Females feed mainly on birds and pigs (Colless, 1959), but are also known to bite cattle, dogs, and man. *Culex sitiens* is a potential vector of human pathogens. Experimental transmission of Japanese encephalitis virus has been demonstrated in the laboratory (Hodes, 1946, as *jepsoni* Theobald) and it has been found naturally infected with larvae of *Brugia malayi* in Thailand (Iyengar, 1953).

Distribution. This species occurs in the coastal lands of the Oriental Region, southwestern Asia, eastern Africa, and Madagascar. Populations are also known from

the Ryukyu Archipelago, Korea, northern Australia, and many islands in the South Pacific.

Material examined. 544 specimens. A total of 455 specimens (90 females, 85 males, 31 male genitalia, 105 pupal exuviae, 105 larval exuviae, and 39 fourth-instar larvae) were examined from coastal areas of southwestern Asia — OMAN: (Dhofar, Itelba, Salalah, Trucia); P.D.R. YEMEN: (Al Ais, Buaish, Dis Town, Geregeri, Gheil Bawazir, Hami, Hamial Sharq, Harshiyab, Khon, Makhzan, Meifa, Mukalla, Qaiti, Shihr, Sukhal al Dis, Thrilla, Urfat Subai, Wadi Maseila, Wasira, unknown localities); SAUDI ARABIA: (Jeddah); UNITED ARAB EMIRATES: (Sharja); YEMEN ARAB REPUBLIC: (Hodeidah). An additional 89 specimens (40 females, 15 males, 4 male genitalia, 10 pupal exuviae, 4 larval exuviae, and 16 fourth-instar larvae) were examined from DJIBOUTI, INDIA (the type specimens of *microannulatus*), SOCOTRA, SUDAN (including the type specimens of *salus*), and unknown localities. An unknown number of specimens from Southeast Asia and the type specimens of *impellens*, *gnophodes*, and *jepsoni* were also examined.

Culex (Culex) poicilipes (Theobald)

poicilipes Theobald, 1903b: ix (*Lasioconops*). +Holotype female: Bonny, [Eastern Provinces], Nigeria (BM).

quasigelidus Theobald, 1903a: 181. +Lectotype female, hereby designated, bearing following data: "Type // Entebbe / Dr. Row // Culex / quasigelidus / (Type) Theobald // Entebbe. / bred from / larvae. / Sep. 20. 02"; left wing mounted on slide (BM). Synonymy with *poicilipes* by Edwards, 1932a: 203; incorrectly considered as senior synonym of *poicilipes* by Edwards, 1911:258.

taeniorhynchoides Giles, 1904: 369. +Holotype female: Benguela, Angola (BM). Synonymy with *quasigelidus* by Edwards, 1911: 258.

maculipes Theobald, 1904: 79 (*Taeniorhynchus tenax* var.). +Holotype female: Kenissa, White Nile and Middle Sobat, Sudan (BM). Synonymy with *quasigelidus* by Edwards, 1911: 258.

madagascariensis Ventrillon, 1905b: 427 (*Pseudoheptaphlebomyia*). +Lectotype female, hereby designated, bearing following data: "9 // MUSEUM PARIS / [Tananarive,] MADAGASCAR / VENTRILLON 1905 // Pseudohepta- / phlegomyia [sic] / madagasca- / riensis Ventr. / type." (MNHP). Synonymy with *quasigelidus* by Edwards, 1911: 258.

par Newstead, 1907 (in Newstead et al., 1907: 25). +Holotype female: Tshumbiri, [Leopoldville], Belgian Congo (BM). Synonymy with *quasigelidus* by Edwards, 1912b: 29.

punctipes Theobald, 1907: 316 (*Aporoculex*). +Holotype female: Chinde, [Zambezia, Mozambique] (BM). Synonymy with *quasigelidus* by Edwards, 1911: 258.

auritaenia Enderlein, 1920: 49. +Lectotype female, hereby designated, bearing following data: "Madagaskar / Tanararivo [sic] / Friederichs S.V. // Type // Culex / auritaenia / Type Enderl. [female symbol] / Dr. Enderlein det. 1920 // 1920. 375." (BM). Synonymy with *poicilipes* by Edwards, 1932a: 203.

- Culex poicilipes* (Theobald) of Lewis, 1945: 14 (Sudan, distr.); Theodor, 1952: 113 (Egypt, zoogeogr.); Senevet et al., 1957a: 86 (North Africa, L*); El-Said and Kenawy, 1983a (Egypt, distr.).
- Culex (Culex) poicilipes* (Theobald) of Edwards, 1941: 289, 415, 482 (Afrotropical Region, A key, M*, F*, P*, syn., distr.); Lewis, 1943a: 281 (Eritrea, coll. rec.); Lewis, 1943b: 68 (Sudan); Abbott, 1948: 44 (Sudan, distr.); Lewis, 1948: 144-148 (Sudan, A, L bionomics); Hopkins, 1952: 280 (Afrotropical Region, L key, L*, bionomics); Mattingly, 1954: 58 (Africa, zoogeogr.); Lewis, 1956: 705 (Sudan, distr., bionomics); Ovazza et al., 1956: 167 (Ethiopia, coll. sites); Senevet et al., 1957b: 92 (North Africa, L); Senevet and Andarelli, 1959: 135 (Egypt, A, L, P keys, syn., M*, F*, P*, L*, distr., biol., L assoc.); DuBose and Curtin, 1965: 351-354 (Mediterranean area, A, L keys); Mekuria, 1968: 78 (Ethiopia, distr.); El-Said and Kenawy, 1983b (Egypt, coll. rec., distr.); Harbach, 1985a: 86, 96, 107 (Egypt, Israel, A, L keys.).
- Culex quasigelidus* Theobald of Wesche, 1910: 38 (West Africa, P*, L*, keys); Edwards, 1912c: 381 (Africa, L, key); Gough, 1914: 135 (Egypt, coll. rec.); Storey, 1918(1919): 86-98 (Egypt, A, L keys, A); Ingram and Macfie, 1919: 66 (W. Africa, P*, L); Kirkpatrick, 1924(1925): 367, 371 (Egypt, A, L keys); Scott, 1927: 88 (Ethiopia, coll. rec.); Abdel-Malek, 1956: 105 (Sinai, L key).
- Culex (Culex) quasigelidus* Theobald of Edwards, 1921: 337 (Egypt, A, L keys, tax., bionomic note, distr.); Séguy, 1924: 29, 185 (Egypt, A key, A, L, tax., distr., syn.); Kirkpatrick, 1925: 107, 186 (Egypt, syn., M*, F, P*, L*, distr., bionomics); Edwards, 1926: 129 (Egypt, A, L keys, A, L, distr.); Stackelberg, 1927: 152 (Egypt, M, F keys, A, M gen.*, distr.); Martini, 1931: 380 (Egypt, A, L keys, M*, F, L, distr.).

Adult. A rather large species easily distinguished from other species of the subgenus *Culex* by the presence of rows of pale spots on the femora and tibiae. It bears a superficial resemblance to *tigripes* De Grandpre and De Charmoy of the subgenus *Lutzia* which also has spotted legs, but these species do not occur together in southwestern Asia and are distinguished without difficulty by the characters given in the key to subgenera.

FEMALE. *Head:* Antenna dark; pedicel with small patch of pale scales on mesal surface; length 1.5-1.9 mm, mean 1.7 mm. Proboscis dark-scaled with sharply defined median pale ring extending from 0.4 to 0.6 from base; length 1.8-2.1 mm, mean 1.9 mm. Maxillary palpus dark-scaled, with pale scales at apex and also usually on dorsal surface of palpomere 2; length 0.4-0.5 mm, about 0.25 proboscis length. Forked scales of vertex dark; narrow falcate scales yellowish and yellowish brown; postocular and postgenal areas with white spatulate scales, these often divided into dorsal and ventral patches by anterior extension of posterior black scales, white patches usually connected along margin of eye. *Thorax:* Integument usually black, sometimes dark brown. Scutum mainly with dark brown scales, with variable amount of whitish or yellowish to yellowish-brown scaling, principal areas of pale scaling include median area of anterior 0.33, paired sublateral areas at middle, and transverse band behind middle; small but conspicuous patch of long white near-linear scales on antealar area; some whitish or pale yellow scales around bare part of prescutellar area. Scutellum largely covered with yellowish-brown falcate scales. Ante- and postpronota with golden-brown falcate scales, antepronotum with paler scales dorsally and/or ventrally, postpronotum with few slightly lighter scales at extreme ventral angle. Proepisternum with lower patch of pale scales in addition to usual upper patch, upper patch rather large, extending ventromesally on

anterior surface; with 9-13 setae in upper area. Mesopleuron with usual patches of white spatulate scales on katepisternum and epimeron; with numbers of setae as follows: 8-14 prealar, 3-8 upper mesokatepisternal, 6-12 lower mesokatepisternal, 6-10 upper mesepimeral, and no lower mesepimeral. *Wing*: Length 3.4-4.6 mm, mean 4.0 mm; length of cell R2 3.6-4.7 length of vein R2+3, mean 4.0; length of cell M1/length of cell R2 0.75-0.85, mean 0.81; mainly brown-scaled, with variable pale scaling; pale scaling sometimes absent or indistinct, sometimes limited to patches at base and apex of costa, but usually more extensive (particularly in dark individuals) as follows: patch at base of costa before humeral crossvein; scattered along posterior margins of costa and subcosta; line on posterior margin of costa distal to intersection of subcosta; scattered along anterior margin of R1 before level of furcation of R2+3; lines on anterior and posterior margins of R1 beyond furcation of R2+3. *Halter*: Pedicel and scabellum yellow; capitellum dark. *Legs* (midleg, Fig. 2J): Anterior surface of forecoxa with mixture of dark and pale scales, sometimes almost completely pale-scaled, often nearly all dark-scaled; anterolateral surface of midcoxa with mixture of dark and pale scales; hindcoxa with lateral line of pale scales. Femora with pale scales encircling base and covering posterior surface; anterior surfaces dark brown-scaled with row of 7-9 yellowish-white spots, spots fewer and larger on hindfemur; with narrow pale knee spots. Tibiae like femora; pale spots more distinct on fore- and midtibiae than on hindtibia; spots slightly dorsal on foretibia and in more or less double row; with pale scales at apex. Tarsi with pale rings on base and apex of tarsomeres 1-3 and base of tarsomere 4, basal rings broader. *Abdomen*: Terga II-VII mainly dark brown-scaled with variable basal pale bands and lateral pale spots; basal bands of terga II and III produced medially; most of middorsal surface pale on terga VI and VII; basal bands continuous with lateral spots except perhaps on more proximal terga; lateral spots progressively larger from anterior to posterior terga. Sterna largely pale-scaled; often with indistinct V-shaped patch of dark scales, base of V at middle of anterior margin.

MALE. Same as female except as follows. *Head*: Proboscis paler; with many pale scales mixed with dark ones; mostly pale beneath; often pale at sides before labella. Maxillary palpus with 6 pale areas as follows: (1) lateral pale area at base of palpus without scales, (2) narrow pale ring across junction of palpomeres 2 and 3 without scales, (3) broad dorsolateral pale area at middle of palpomere 3 with pale scales, (4) pale area at apex of palpomere 3 and base of palpomere 4, latter with pale scales dorsally and ventrally, (5) pale area at apex of palpomere 4 and base of palpomere 5, latter with small patch of pale scales dorsally and ventrally; (6) pale area on approximately distal 0.5 of palpomere 5 with line of pale scales on dorsal and ventral surfaces; palpomeres 4 and 5 often with scattered pale scales on ventral surface; length 2.6-3.3 mm, mean 3.0 mm. Forked scales of vertex pale medially, becoming dark laterally and posteriorly; falcate scales paler, whitish to yellow; spatulate scales becoming yellowish ventrally. *Thorax*: Upper proepisternal scales numerous, about 35. Scutal scales smaller, more numerous and paler, those of fossae largely golden yellow; band behind middle pale yellow. Scutellar scales narrower and paler. Pleural scale-patches generally paler. *Wing*: Length 3.1-4.2 mm, mean 3.7 mm; length of cell R2/length of vein R2+3 variable, 2.1-4.1, mean 2.7; pale scaling less distinct, wing paler overall; pale scaling reduced along posterior margin of R1. *Abdomen*: Terga II and III with medial extension of basal band often reaching posterior margin; terga VI and VII sometimes entirely pale-scaled. *Genitalia* (Fig. 33): Form as figured; lateral plate of phallosome somewhat as in *sitiens*. Ninth tergal lobe scarcely produced, with row of 5-9 (mode 8) irregularly spaced setae. Gonocoxite rather elongate, lateral setae extending from near base to apex, in 2 or 3 rows increasing to about 5 rows at level of subapical lobe; subapi-

cal lobe undivided, not very prominent; setae *a-c* slender, about same length, *a* blunt at tip, *b* and *c* hooked at tip; only 2 simple setae in group *d-f*, one acute, the other (*f*?) slightly flattened and hooked at tip; *g* and *h* essentially as in *sitiens*; a noteworthy auxiliary seta (*aux*) present basally on proximal side of lobe. Gonostylus not unusual. Phallosome longer than broad; aedeagal sclerite slightly longer and narrower than lateral plate, ventral margin deeply excavated in middle; inner division of lateral plate closely fused to ventromesal margin of outer division, shape much as in *sitiens* but with 3-5 more massive teeth arising between dorsocaudal angle and mesal surface of outer division, teeth resemble a hand with stubby fingers directed dorsolaterally, dorsomesal margin with tiny bumps and spicules; outer division with large concavo-convex flap arising from dorsocaudal margin, dorsal process and basal articulatory process poorly developed. Proctiger large; paraproct long and slender, without basal lateral arm, crown a large mass of short spinelike spicules. Cercal sclerite elongate, somewhat triangular; 2-6 (mode 4) cercal setae. Tergum X small.

Pupa (Fig. 33). Form and positions of setae as figured, range and modal number of branches in Table 36; usually easily recognized by the presence of a darkened area on the paddle (not illustrated). *Cephalothorax*: Setae 1,3,8-CT usually with 3 or 4 branches (see table); 2-CT usually with 4 or 5 branches (3-5); 4,6-CT usually triple (2-4); 5-CT usually with 4 or 5 branches (4-6), not much longer than 4-CT; 7,11-CT double or triple, more often double; 10-CT multiple (7-16); 12-CT with 3-6 branches occurring in nearly equal frequencies, longer than 10,11-CT. *Trumpet*: Lightly to moderately tanned, tracheoid area and pinna darker; index 5.7-7.5, mean 6.8; pinna short, 0.1-0.2 length of trumpet. *Abdomen*: Length 3.1-3.6 mm, mean 3.4 mm; caudolateral angle of terga VII and VIII acute. Seta 7-I double or triple, 7-II usually double, sometimes single or triple; 1-III-V strongly developed, multiple, about length of following tergum; 6-III-VI moderately developed, usually with 4 or 5 branches (3-6), 6-VI distinctly longer than the others; 5-IV usually triple (3-5), about length of 1-IV, shorter than 5-V,VI which are double and considerably longer than following terga. *Paddle*: Lightly tanned, with darkened area on distal 0.5 or less and mainly on inner part; length 0.91-1.16 mm, mean 1.00 mm, width 0.68-0.82 mm, mean 0.74 mm, index 1.2-1.5, mean 1.4.

Larva (Fig. 34). Character and placement of setae as figured, range and modal number of branches in Table 36; recognized at once by the shape of the siphon, and black pigmentation of posterior part of thorax and abdominal segments III and V which give the larva a 3-banded appearance in life. *Head*: Length 0.82-0.95 mm, mean 0.89 mm; mainly lightly tanned, darker posteriorly, ventral part of lateralia adjacent to hypostomal suture sometimes with dark triangular spot. Median labral plate noticeably produced forward at point of insertion of seta 1-C. Dorsomentum usually with 6 teeth (5-7) on either side of middle tooth. Seta 1-C short, stout, pointed, dark; 2-C occasionally present; 4,5,6-C inserted more posterior than usual, 5,6-C only extending to near base of 1-C; 4-C short, usually double (1-3); 5-C most often with 4 branches (3-5); 6-C distinctly shorter than 5-C, often with 4 branches (4-6); 7-C strongly developed, usually with 10, 11 or 12 branches (10-15); 8,9,10-C generally with more branches than usual, 10-C usually with 4 or 5 branches (3-5); 11-C double, seldom triple; 14-C rather spiniform, normally single (1,2). *Antenna*: Length 0.76-0.86 mm, mean 0.80 mm; tanning and spiculation as usual; scape developed. Seta 1-A large, with about 34 branches (29-37); 2,3-A inserted near apex. *Thorax*: Integument hyaline, smooth; with concentration of black pigment granules under dorsal surface of meso- and metathorax. Setae 4,8-P double, about same length; 7-P with 3 or 4 branches, perhaps slightly longer than 4,8-P. Setae 1,4-M similar, both with more branches than usual, 1-M often with 5 branches (5-8), 4-M usually with 4 or 5 branches (4-6). Seta 1-T multiple

about 0.5 length of 1-T; 2-T also multiple, most often with 4 branches (3-5); 12-T double or triple; 13-T with more branches than usual (12-23), not much longer than 12-T. *Abdomen*: Integument hyaline, smooth; dark pigment granules present, particularly noticeable in segments III and V (as in *antennatus* and *sinaïticus*). Seta 3-I multiple (2-7), infrequently double or triple, 3-II-IV usually with 3 or 4 branches (see table), 3-V, VI double or triple, 3-VII highly branched (7-10); 6-I-VI normally triple, some occasionally with 4 branches, 6-V usually distinctly shorter than the others; 7-I usually double (1,2) but as long as 6-I, 7-II-VII generally with more branches than usual (see table); 1-III-VII usually with 7 or 8 branches (see table). *Segment VIII*: Comb consisting of 6-10 (mode 7) large spinelike scales, fringed on either side at base. Seta 2-VIII double or triple; 5-VIII generally with more branches than usual (5-7). *Siphon*: Index 3.59-4.66, mean 4.22; moderately tanned; slightly but distinctly bent anteriorly, posterior side longer than anterior side; spiracular lobes particularly large. Pecten composed of 8-14 (mode 11) short spines with 4-9 (mode 5) basal denticles, most basal denticles tend to be fused. Seta 1-S in 5 pairs, middle pair borne laterally, others on posterior midline, length of latter more than twice diameter of siphon at point of attachment. *Segment X*: Saddle complete, rather long, length 0.43-0.52 mm, mean 0.48 mm, siphon/saddle index 2.54-3.07, mean 2.78. Seta 1-X usually with 4 branches (2-5); 2-X often with 5 branches (3-7); 4-X in 6 or 7 pairs, branches numerous. Length of anal papillae variable, ventral pair usually, but not always, longer than dorsal pair.

Systematics. *Culex poicilipes* is widely distributed south of the Sahara and along the Nile River into Egypt. The species occurs in the Sinai Peninsula and the Negev of Israel where it probably spread from the Nile Delta in relatively recent times. The species is strikingly distinct in all stages and cannot be confused with any other species of *Culex* occurring in Egypt or Israel.

This is one of the most variable species of *Culex* in Africa. Remarkable variation occurs in the ornamentation of the adults and the chaetotaxy of the larva. Much of this variation is undoubtedly individual, but there are indications that some populations differ constantly from others. A noticeably darker adult form with less extensive pale markings is common in some areas. Whether this is due to genetic or environmental factors cannot be determined without sufficient individually reared material collected throughout the recorded range of the taxon. The adult and immature stages of *poicilipes* in Egypt and Israel are not so variable and it is unlikely that more than one species is involved in these countries.

The placement of *poicilipes* in the *sitiens* subgroup is provisional. It is included chiefly because of overt similarities in the structure of the male phallosome. There are important differences in all life stages. The adults differ in having proepisternal scales and ornate markings. The larval and pupal stages differ in the development of many setae. Despite the differences in chaetotaxy, the larval head capsule, comb scales, and siphon are constructed almost like those in the aberrant *Culex whitmorei* (Giles, 1904) which is currently recognized as a member of this subgroup (Sirivanakarn, 1976). It is very likely that both *poicilipes* and *whitmorei* will have to be placed in separate subgroups after members of the *sitiens* group are studied more thoroughly.

Bionomics. The immatures of this species generally inhabit clean bodies of standing water with thick vegetation. The breeding places are normally exposed to full sunlight. Rice fields, shallow pools, and ditches are common breeding sites in Egypt. This mosquito is often associated with *antennatus*, *perexiguus*, and *Anopheles (Cellia) pharoensis* Theobald, but rarely with other species. Adults enter houses in Egypt (Kirkpatrick, 1925) and readily attack man near swamps in the Sudan (Lewis, 1956), but are not known to vector any pathogens of human disease.

Distribution. *Culex poicilipes* is widely distributed south of the Sahara and enters Egypt along the Nile. Populations occur in the Sinai Peninsula and the Negev Desert of southern Israel.

Material examined. 294 specimens. A total of 122 specimens (74 females, 14 males, 5 male genitalia, 10 pupal exuviae, 9 larval exuviae, and 10 fourth-instar larvae) were examined from southwestern Asia — EGYPT: *Beni Suef* (Biba), *El Bahayrah* (Alexandria), *El Buhayra* (Mansura, Wadi Natrun), *El Isma'iliya* (Abu Khalifa, Isma'iliya), *El Fayyum* (Birket Qarum), *El Giza* (Harania, Kafr el Ghataty, Kerdasa), *El Qulyubiya* (Ezbet Ayoub), *El Sharqiya* (Inshas el Raml); ISRAEL: (Ha'arana, Iddan, Neot Hakikar, Yeroham, Zikim). An additional 172 specimens (95 females, 39 males, 7 male genitalia, 3 pupal exuviae, 5 larval exuviae, and 23 fourth-instar larvae) were examined from ANGOLA (the holotype female of *taeniorhynchoides*), BENIN, ETHIOPIA, GAMBIA, GHANA, KENYA, MADAGASCAR (including the types series of *madagascariensis* and *auritaenia*), MALAWI, MALI, MAURITANIA, MOZAMBIQUE (the holotype female of *punctipes*), NIGERIA (including the holotype female), SENEGAL, SOUTH AFRICA, SUDAN (including the holotype female of *maculipes*), TANZANIA, UGANDA (including the holotype female of *par*), ZIMBABWE, and unknown localities.

Culex (Culex) mimeticus Noè

mimeticus Noè, 1899: 240. Type(s) (female): Grassano in Basilicata, [Italy] (non-extant).

pseudomimeticus Sergeant, 1909: 445. Type(s) (adult): Oued Chiffa, Algeria (non-extant). Synonymy with *mimeticus* by Edwards, 1932a: 205.

Culex mimeticus Noè of Giles, 1901a: 605 (India, A, distr.); Theobald, 1901a: 329 (India, A key, F*); Christophers, 1906: 9 (? India, L); Joyeux, 1918: 533 (Macedonia, coll.); Waterston, 1918: 9 (Macedonia, A, L habitat); Barraud, 1921: 395 (Israel, Jordan, Syria); Edwards, 1922: 284 (Oriental Region, A, key); Barraud, 1923: 941 (India, L*); Buxton, 1923: 316 (Israel, Jordan, coll. rec., biol. note); Theodor, 1923: 341 (Jordan, Israel, P*, key); Barraud, 1924a: 991 (India, A key, M*, F); Parr, 1943: 246-250 (Syria, Lebanon, A, P, L keys, bionomics); Senevet, 1947b: 212 (North Africa, L key); Theodor, 1952: 113 (Middle East, zoogeogr.); Dow, 1953: 688 (Iran, coll. rec.); Senevet et al., 1957a: 86 (North Africa, L*); Margalit and Tahori, 1973: 90-93 (Sinai, distr., L assoc.); Margalit et al., 1973: 32 (Israel, coll. rec., L assoc.); Kitron and Pener, 1986 (Israel, L bionomics).

Culex (Culex) mimeticus Noè of Edwards, 1921: 337 (E. Mediterranean Region, Israel, Jordan, A, L keys, tax., distr.); Séguy, 1924: 34, 186 (E. Mediterranean Region, Israel, Jordan, A, L keys, L*, tax., distr., syn.); Edwards, 1926: 130 (E. Mediterranean Region, Israel, Jordan, A, L keys, A, L, L assoc., distr.); Stackelberg, 1927: 155 (Middle East, M, F keys, A, M gen., distr.); Martini, 1931: 371 (Israel, Jordan, Turkey, A, L keys, M*, F, L*, distr.); Barraud, 1934: 409 (India, A, L keys, M*, F, L*, distr.); Edwards, 1934: 451 (India, F, distr.); Senevet, 1947a: 121 (Egypt, L*, distr., L assoc.); Senevet, 1949: 56 (North Africa, M gen.*, key); Monchadskii, 1951: 266 (Middle East, L*, L assoc., distr.); Senevet and Andarelli, 1954: 57 (North Africa, M, F, A key); Senevet et al., 1957b: 92 (North Africa, L); Parrish, 1959: 266 (Turkey, distr.); Senevet and Andarelli, 1959: 151 (North Africa, A, P, L keys, syn., M*, F*, P*, L*, distr., biol., L assoc.); Abdel-Malek, 1960:

112-121 (Syria, coll. sites, L bionomics); Derwesh, 1965: 44 (Iraq); DuBose and Curtin, 1965: 351, 354 (Mediterranean area, A, L keys); Abul-hab, 1966: 283 (Iraq, distr., L bionomics); Abul-hab, 1968: 246 (Iraq, L key, distr.); Lotfi, 1970: 401 (Iran, coll. rec.); Margalit and Tahori, 1970b: 152 (Israel, coll. sites, distr.); Aslamkhan, 1971: 154 (Pakistan); Lotfi, 1973: 206 (Iran, coll. sites); Gutsevich et al., 1974: 375 (Middle East, F, M gen., L keys, M*, F*, L*, distr., bionomics); Margalit and Tahori, 1974: 87 (Israel, coll. rec.); Lotfi, 1976 (Iran, L key, L*, ecol. note); Sirivanakarn, 1976: 145 (Oriental Region, A, P, L keys, M*, F*, P*, L*, syn., tax., distr., bionomics); Ibrahim et al., 1983: 91 (Iraq, L*, key); Harbach, 1985a: 86, 96, 107 (SW Asia [excluding records for Afghanistan and Saudi Arabia], Egypt, distr., A, L, key).

Adult. The presence of pale spots on the wings of this medium-sized species readily distinguishes it from all other species of *Culex* known to occur in southwestern Asia and Egypt. This character evokes a superficial resemblance to *Anopheles* species of the subgenus *Cellia*.

FEMALE. *Head:* Antenna dark; length 2.0-2.3 mm, mean 2.1 mm; pedicel with small patch of tiny pale scales on dorsal surface. Proboscis black-scaled with well defined median whitish ring extending from 0.4 to 0.6 from base; length 1.9-2.1 mm, mean 2.0 mm. Maxillary palpus dark with pale scales at apex. Forked scales of vertex pale yellow medially, dark brown to black laterally; falcate scales white, yellowish dorsolaterally; lateral spatulate scales white. *Thorax:* Integument brown, pleura with darker spots on proepimeron, postspiracular area, prealar area, anterior and posterior margins of mesokatepisternum, and anterior and upper areas of mesepimeron; meron also dark. Scutal scales coarse, predominantly pale yellow to golden yellow, with white to pale yellow scales on anterior promontory, lateral margins and prescutellar area, scales on fossa and middorsal area sometimes golden brown to brown. Scutellum with white falcate scales, large patch on median lobe, few on lateral lobes. Ante- and postpronota with golden-yellow falcate scales; postpronotum with about 6 setae on posterior border. Pleura with patches of white spatulate scales as follows: proepisternum with patch immediately above forecoxa, mesopleuron with upper and lower patches on katepisternum and anterior and upper patches on anepimeron, scales on katepisternum more elongate; numbers of pleural setae: 4-8 upper proepisternal, 10-12 prealar, 5-7 upper mesokatepisternal, 9-13 upper mesepimeral; without lower mesepimeral seta. *Wing* (Fig. 2E): Length 3.8-4.0 mm, mean 3.9 mm; black-scaled with white or yellowish-white spots, pattern follows: costa dark with sector, subcostal and preapical pale spots; R1 dark with subcostal and preapical pale spots; pale scales at apex of R2+3 continuous with pale scales at base of R2 and R3; R2 with preapical pale spot; R4+5 with dark base followed by large median pale spot and small apical dark spot; pale spot at furcation of M1+2; M3+4 with large median pale spot; CuA with very small pale spot at apex confluent with pale fringe spot; 1A with large pale spot near middle. *Halter:* Pedicel and scabellum yellow; capitellum brown with pale scales. *Legs* (Fig. 2H): Forecoxa black-scaled with patch of white scales at base; mid- and hindcoxae with longitudinal stripe of white scales on anterior side of lateral midline. Anterior surface of forefemur entirely black-scaled with ill-defined narrow line of white scales on proximal 0.5, with distinct posterodorsal stripe of white scales not reaching apex; anterior surface of midfemur black-scaled with white scales at base, posterior surface white-scaled with small subapical area of black scales; hindfemur white-scaled except for dorsal stripe of black scales beginning near base and broadening distally to cover approximately distal 0.25 of anterior and posterior surfaces. Tibiae and tarsi mainly black-scaled; all tibiae with

posterior white stripe, mid- and hindtibiae with narrow anterior white stripe, anterior stripe of midtibia incomplete distally, anterior stripe of hindtibia incomplete at ends. Tarsomeres 1-4 of all legs with basal and apical white rings, basal rings broader. *Abdomen*: Terga mainly black-scaled; tergum I with submedian patches of black scales on posterior border that may be separated by a few median pale scales; terga II-VII with basal bands of yellowish-white scales and large basolateral spots of white scales, spots may cover entire lateral surface, bands straight or slightly convex, 0.15-0.35 tergum length and barely if at all reaching spots. Sternum I with some dark scales near posterolateral corners; sterna II-VII with posterolateral dark spots that may join to form broad apical band.

MALE. Resembling female, differences follow. *Head*: Maxillary palpus with broad subapical ring of pale scales on palpomere 3, narrow ring of pale scales at bases of palpomeres 4 and 5, and pale scales on dorsal surface of palpomere 5. Vertex with fewer forked scales; falcate scales fewer, longer and all yellowish white; larger patch of pale lateral spatulate scales. *Thorax*: Scutal scales longer, predominantly whitish to golden yellow with spots of golden-brown scales on fossae and middorsal area, lightest scales on lateral margins and posterior 0.33 of scutum. Scutellar scales fewer and longer. Upper proepisternal setae more numerous, usually 8-10. *Wing*: Length 2.9-3.3 mm, mean 3.1 mm; pattern of spots differs as follows: sector pale spot on anterior margin of subcosta; pale spots at apex of costa, R1 and R2; pale spots absent from furcation of R1+2, furcation of M1+2 and apex of CuA; M3+4 with small basal dark spot followed by small pale spot and large dark spot; 1A pale spot extending further proximad than in female. *Abdomen*: Without basolateral spots; basal pale bands concave, 0.35-0.45 tergum length on dorsal midline. *Genitalia* (Fig. 35): Form as figured; structure much as in *sitiens*, differing chiefly as follows. Ninth tergal lobe poorly differentiated, with 4-7 short setae. Subapical lobe of gonocoxite with 3 or 4 setae in group *d-e*, 3 usually present, these flattened with recurved apex and 1 or 2 recurved denticles before tip; seta *f* flattened and bladelike, rounded apically; *h* longer. Inner division of phallosome more closely fused to outer division, not as broad, dorsocaudal angle elongate and slender, with 1-3 teeth (usually 2) arising very near tooth on posteromesal margin of outer division; outer division with much smaller process projecting laterally from ventrocaudal margin, dorsal process not as prominent. Proctiger essentially as in *sitiens*; basal lateral arm of paraproct generally shorter and more slender. Cercal sclerite with 2 or 3 setae on posterolateral corner. Tergum X small.

Pupa (Fig. 35). Placement and form of setae as figured, range and modal number of branches in Table 17; without striking distinctive features, closely resembles *sitiens* but setae 1-II, 6-III-VI, and 9-VIII usually with fewer branches. *Cephalothorax*: Lightly tanned. All setae except 10-CT usually double or triple, more often double; 10-CT usually with 4 or 5 branches (4-6). *Trumpet*: Moderately tanned; slender, pinna slightly widened; index 4.7-7.0, mean 5.9; pinna 0.25-0.40 trumpet length. *Abdomen*: Lightly tanned; length 2.6-3.9 mm, mean 3.2 mm. Seta 6-I,II short, not more than twice length of 7-I,II; 7-I,II usually double (1-3); 1-II weak, with only 1-4 branches, 1-III-V generally with progressively fewer branches on each successive posterior tergum, 1-III frequently with 4 or 5 branches (3-6), 1-IV most often triple (2-5), 1-V usually double (1-3), 1-VI commonly single (1,2), 1-VII like 1-V; 6-III-VI usually single (see table), 6-III,IV distinctly shorter than 6-V,VI; 5-IV-VI strongly developed, about 1.5 length of tergum following, 5-IV most often double (2-4), 5-V,VI double; 2-VII usually mesal to 1-VII; 9-VIII usually with 6 or 7 branches (4-9). *Paddle*: Lightly tanned; length 0.76-1.03 mm, mean 0.94 mm; width 0.59-0.78 mm, mean 0.67 mm; index 1.3-1.6, mean 1.5.

Larva (Fig. 36). Character and positions of setae as figured, range and modal

number of branches in Table 37; resembling *theileri*, *simpsoni*, and *sinaiticus* in the form of the comb scales but differing conspicuously from these species in the placement of seta 1-S and in having setae 2,3-A inserted approximately midway between seta 1-A and apex of antenna, easily distinguished from other members of the *sitiens* group by the character of the comb scales and the reduced branching of seta 4-X. *Head*: Length 0.60-0.72 mm, mean 0.66 mm; width 0.95-1.10 mm, mean 1.05 mm; lightly tanned, darker posteriorly. Hypostomal suture ending before collar; collar well developed, heavily tanned. Dorsomentum almost shape of an equilateral triangle; usually with 7 or 8 teeth (6-8) on each side of middle tooth. Seta 1-C moderately long, stout, pointed, tanned; 2-C absent; 4-C double, triple, or with 4 branches occurring in nearly equal frequencies; 5-C with 3 or 4 branches, more often with 4; 6-C double or triple, more often double; 14-C rather large and spinelike. *Antenna*: Length 0.46-0.62 mm, mean 0.55 mm; lightly tanned, distal part dark, with dark ring at base. Seta 1-A with about 25 branches (21-27); 2,3-A inserted almost halfway between 1-A and apex. *Thorax*: Integument hyaline, smooth. Setae 1-6-P equally long and single; 7-P usually triple, seldom double; 8-P double or triple in nearly equal frequencies, distinctly shorter than 7-P. Seta 1,2-T usually single, occasionally double, 2-T 2 or 3 times as long as 1-T; 13-T weak, shorter than 12-T, usually double, occasionally single or triple. *Abdomen*: Integument hyaline, smooth. Seta 3-I,IV single or double, 3-II,III,V,VI almost always single, 3-VII often double but frequently triple or with 4 branches; 6-I-V usually triple, 6-I,II often with 4 branches, 6-VI usually double, occasionally triple; 7-I as in *sitiens*; 1-III short and single, 1-IV-VI usually double, 6-V,VI stronger than 6-IV, 1-VII triple or with 4 branches, more often with 4; 13-III-V,VII weakly developed, much shorter than seta 1 of same segment, almost always single or double. *Segment VIII*: Comb with 27-50 (mean 33) sharply pointed scales with short lateral fringes on proximal part. *Siphon*: Index 4.55-7.41, mean 6.07; lightly tanned, slightly darker at apex, basal rim moderately to heavily tanned. Pecten composed of 13-20 (mode 15) long slender spines with rather short line of fused denticles at base. Seta 1-S in 5-7 pairs (10-14 setae), 1 subapical pair borne laterally, others along posterior midline, proximal 4 or 5 pairs stronger, most often with 4 or 5 branches (see table), lateral pair and most distal pair shorter and usually double or triple; 2-S rather long and curved. *Segment X*: Saddle complete; lightly tanned, slightly darker posteriorly; with rows of minute spicules; length 0.37-0.42 mm, mean 0.41 mm, siphon/saddle index 3.90-4.65, mean 4.22. Seta 1-X normally double (1-3); 2-X normally double, occasionally triple; 4-X usually in 6 pairs, 1 seta sometimes unpaired, most setae commonly with 4 branches (3-6). Anal papillae long and slender, about twice length of saddle.

Systematics. This species is the nominate member of an interesting subgroup which is largely confined to the Oriental Region. *Culex mimeticus* is the only species of the group which is known to occur in the Mediterranean Subregion of the Palaearctic. It is apparently mainly a chaparral and temperate grassland species which is excluded from the Arabian Peninsula and the Sahara.

The adults of *mimeticus* are unique among the *Culex* of southwestern Asia in having spotted wings much as in species of the subgenus *Cellia* of *Anopheles*. The larva is variable but distinct from all other species in the region. It bears a very superficial resemblance to the larva of *Culex deserticola* Kirkpatrick, 1924(1925), but is distinguished at once from this species by the placement of setae 2,3-A and the character of the comb scales.

It is possible that two or more species are currently confused under the concept of *mimeticus* in the Mediterranean Subregion. Topotypic material from Italy, for example, differs noticeably in the size and shape of the pupal trumpet. There also seems to be a number of geographically isolated populations in the region. Individual rearings are lacking from almost all localities and the available material is much too scanty to permit a detailed comparative analysis. The above diagnosis is based mainly on reared material from the Negev of Israel.

Bionomics. The natural breeding sites of *mimeticus* appear to be springs and residual pools in drying streams. The water in these habitats is fresh and clear and usually contains growths of *Spirogyra*. Other collections have been made at the margins of streams, pools in swampy ground, irrigation ditches, and animal hoofprints. Larvae are frequently found with *Anopheles (Cellia) hispaniola* (Theobald), *An. (Cel.) sergentii* (Theobald), and *An. (Cel.) superpictus* Grassi. Adults apparently occasionally enter human habitations (Hsiao and Bohart, 1946; Ribeiro et al., 1977), but females have never been seen landing on or biting man or animals. Nothing is known about the biology of the adults.

Distribution. This species occurs in the southern Palaearctic and Oriental regions. Its range extends from lands around the Mediterranean to eastern and southeastern Asia. *Culex mimeticus* seems to be less common than it once was, probably as a result of pesticide usage, organic pollution, and the destruction of preferred breeding places. The species has a very spotted distribution.

Material examined. 215 specimens. A total of 128 specimens (26 females, 27 males, 24 male genitalia, 15 pupal exuviae, 17 larval exuviae, and 19 fourth-instar larvae) were examined from southwestern Asia — IRAN: (Amirabad, Chalus, Izeh-Ahwaz, Kanroud, Kazeroon, Khorramabad, Natchi Bahrán, Tehran, Zanjan); IRAQ: (Mirgasur); ISRAEL: (Dalia, Ein Amud, En Avedat, Jericho, Jirou, Latron, N. Bet Shearim, N. Moran, Wadi Kabalah, Wadi Kurn); JORDAN: (Jerash, Tafle, Tafilan, Wadi Hasa, Wadi Musa, unknown localities); TURKEY: (Yenice). An additional 87 specimens (24 females, 28 males, 12 male genitalia, 10 pupal exuviae, 11 larval exuviae, and 2 fourth-instar larvae) were examined from ALGERIA, GREECE (CRETE), ITALY (topotypic material), MOROCCO, and TUNISIA.

Culex (Culex) bitaeniorhynchus Giles

bitaeniorhynchus Giles, 1901a: 607 . Type(s) (adult): Travancore, India (non-extant).

ager Giles, 1901b: 196 (*Taeniorhynchus*). Type(s) (female): Madras, Presidency, India (non-extant, lectotype designation of Bram, 1967a: 263 invalidated by Harbach, 1983: 105). Synonymy with *bitaeniorhynchus* by Edwards, 1913c: 231.

ethiopicus Edwards, 1912b: 30 (*Taeniorhynchus ager* var.). +Holotype female: Bole, Gold Coast, West Africa (BM). NEW SYNONYMY.

abdominalis Taylor, 1913: 53 (*Culicelsa*). Type(s) (female): Ayr and Townsville, Queensland, Australia (non-extant). Synonymy with *bitaeniorhynchus* by Edwards, 1913c: 231.

maculipesarabiensis Patton, 1905: 635 (*Taeniorhynchus tenax* var.). Type(s) (adult; larva): D'thala, Hardeba and Nobat, P.D.R. Yemen (non-extant). Synonymy with *ethiopicus* by Edwards, 1941: 291.

karatsuensis Mochizuki, 1913: 28. Type(s) (male; female; egg): Karat-

su, Kyushu, Japan (location unknown). Synonymy with *bitaeniorhynchus* by Edwards, 1932a: 202.

Culex ager var. *ethiopicus* Edwards of Edwards, 1912c: 381 (Africa, L*, key); Ingram and Macfie, 1919: 65 (W. Africa, P*, L*, L habitat).

Culex bitaeniorhynchus Giles of Barraud, 1923: 936 (India, L*); Barraud, 1924a: 984 (in part; India, A key, syn., M*, F, distr.).

Culex bitaeniorhynchus var. *ethiopicus* Edwards of Edwards, 1920: 135 (Africa, M gen.).

Culex (Culex) bitaeniorhynchus Giles of Edwards, 1921: 337 (in part; Palaearctic Region, A, L keys, tax., bionomics, distr.); Edwards, 1926: 129 (in part; Palaearctic Region, A, L keys, syn., A, distr.); Stackelberg, 1927: 153 (in part; S. Asia, M, F keys, A, M gen.*, distr.); Martini, 1931: 362 (in part; S. Asia, A, L keys, M*, F, L*, distr.); Barraud, 1934: 391 (in part; India, A, L keys, M*, F, L*, syn., L habitat, distr.); Monchadskii, 1951: 258 (in part; S. Asia, L*, L assoc., distr.); Lotfi, 1970: 401 (Iran, coll. rec.); Aslamkhan, 1971: 154 (in part; Pakistan); Lotfi, 1973: 206 (Iran, coll. rec.); Gutsevich et al., 1974: 367 (in part; S. Asia, M*, F, L*, distr., bionomics, med. imp.); Lotfi, 1976: 72, 74, 79 (Iran, L key, bionomic note, L*); Sirivanakarn, 1976: 65 (Oriental Region, A, P, L keys, M*, F*, P*, L*, tax., distr., bionomics, med. imp.); Harbach, 1985a: 86, 98, 107 (Iran, Pakistan, P.D.R. Yemen, Yemen Arab Republic, A, L keys).

Culex ethiopicus Edwards of Lewis, 1945: 14 (Sudan, L, distr.).

Culex (Culex) ethiopicus Edwards of Edwards, 1941: 291, 415, 482 (Afrotropical Region, A key, M*, F, P*, syn., distr.); Lewis, 1943a: 281 (Eritrea, coll. rec., L bionomic note); Lewis, 1943b: 69 (Sudan, bionomic notes); Abbott, 1948: 44 (Sudan, distr.); Lewis, 1948: 144 (Sudan, L habitat); Hopkins, 1952: 282 (Afrotropical Region, L key, L*, bionomics); Knight, 1953a: 229 (Yemen Arab Republic, coll. rec., L habitat); Lewis, 1956: 706 (Sudan, coll. rec.); Mattingly and Knight, 1956: 106-132 (P.D.R. Yemen, Yemen Arab Republic, L*, A, L keys, distr., bionomics); Mekuria, 1968: 78 (Ethiopia, distr.).

Adult. A rather large species easily recognized by the speckled wings and rather broad apical yellow bands of the abdominal terga.

FEMALE. *Head:* Antenna dark, pedicel and flagellomere 1 paler; pedicel sometimes with some pale scales on mesal surface; length 1.8-2.4 mm, mean 2.0 mm. Proboscis with distinct median pale ring about 0.25 proboscis length, pair of dorsolateral pale spots at apex before labella and scattered pale scales proximal to ring; length 1.6-2.1 mm, mean 1.9 mm. Maxillary palpus dark-scaled; palpomere 4 with pale scales apically, sometimes with scattered pale scales proximally; length 0.4-0.5 mm, slightly more than 0.2 length of proboscis. Dorsal falcate scales of vertex coarse, very pale yellow; forked scales largely pale yellow to yellowish brown, some darker posterolaterally; lateral and ventral spatulate scales yellowish white. *Thorax:* Integument brownish yellow, scarcely darker dorsally. Scales on anterior 0.7 of scutum mainly pale yellow to golden yellow, somewhat mottled by presence of some golden-brown to brownish scales, particularly on anteromedian area and sublaterally at middle; posterior 0.3 clothed in golden-brown and dark brown scales with some coarser pale scales on antealar area and posteriorly on prescutellar area; scutal setae golden brown except for distinctly paler (yellowish) antealar setae, supraalar setae dark, dense (numerous) and long. Scutellum with pale scales on lateral lobes, median lobe mainly pale-scaled with some brownish-yellow to dark brown scales anteriorly; 5 or 6 long setae on lateral lobes, 7-11 on median lobe. Ante- and postpronota with coarse yellowish to golden falcate

scales, scales golden brown to brown centrally. Pleural setae mainly pale, usually entirely pale: 8-11 upper proespisternal, 6-13 prealar, 5-7 upper mesokatepisternal, 6-10 lower mesokatepisternal, 4-14 upper mesepimeral, and no lower mesepimeral. Pleural scales yellowish white: proepisternum with upper patch comprised of falcate scales laterally and spatulate scales anteriorly, mesokatepisternum with upper and lower patches of elongate spatulate scales, mesepimeron with anterior patch of elongate spatulate scales at level of upper katepisternal patch and patch of similar scales before upper mesepimeral setae. *Wing* (Fig. 2F): Length 3.6-4.6 mm, mean 4.1 mm; length of cell R2 2.4-3.5 length of vein R2+3, mean 3.0; length of cell M1 about 0.9 length of cell R2; dorsal surface with broad apically rounded yellowish-white and brown spatulate scales evenly intermixed on all veins; ventral surface with mixture of pale and dark spatulate scales on costa, subcosta, Rs and M, other veins with pallid brownish linear to very narrow spatulate scales, scales on R1, R4+5, M2 and M3+4 linear and near linear, scales on other veins near linear and very narrow spatulate. *Halter*: Integument yellowish to brownish yellow; capitellum pale-scaled, distal part of scabellum and base of capitellum usually with some dark scales. *Legs*: Forecoxa with dark and pale spatulate scales anteriorly, latter dominant at base and apex; mid- and hindcoxae with anterior patches of pale scales, some dark scales distally. Anterior, posterior, and ventral surfaces of trochanters with mixture of pale and dark scales. Femora with more or less even mixture of dark and pale scales on anterior surface, posterior surface predominantly pale with interspersed dark scales mainly on distal 0.5 or less. Dorsal surface of foretibia and anterior surface of mid- and hindtibiae with interspersed dark and pale scales, ventral surface of foretibia and posterior surface of mid- and hindtibiae mainly pale-scaled with intermingled pallid brown scales, especially proximally. Tarsi dark-scaled; tarsomeres 1-4 with narrow apical and broader basal rings of pale scales; tarsomere 1 of all legs and tarsomere 2 of hindleg with some scattered pale scales. *Abdomen*: Tergum I with rather large median posterior patch of yellow scales, specimens from Asita, Wallo Province, Ethiopia with some rather diffuse dark and pale scales on lateral borders; terga II-VIII with broad apical yellow bands (about 0.33 tergum length) not reaching lateral margins, scattered yellowish scales among proximal dark scales, and large basolateral white spots diagonally opposed to apical bands, tergum VIII also with basal pale band contiguous with basolateral spots that may join apical band medially. Sterna II-VII with narrow yellow apical bands joined medially to broad whitish basal bands, apicolateral corners with dark scales, sometimes with some scattered pale scales, particularly on proximal sterna where dark patches are larger and less definite; sternum VIII with lateral pale patches, middle devoid of scales.

MALE. Like female, differing mainly in sexual characters, major differences follow. *Head*: Median pale ring of proboscis narrow, 0.1-0.15 proboscis length; with ventral setal cluster at base of ring before false joint; false joint about 0.55 from base. Maxillary palpus mainly dark-scaled; with narrow ring of pale integument across junction of palpomeres 2 and 3; palpomere 3 with rather long median pale patch with dispersed dark scales on dorsal and lateral surfaces, sometimes with scattered pale scales distal to pale patch, dense patch of long setae on ventrolateral surface immediately distal to pale patch, and ventromesal surface with line of short antrorsely curved setae along entire length; palpomeres 4 and 5 densely setose with basal pale rings, palpomere 4 with scattered pale scales distal to ring, distal 0.5 of palpomere 5 with pale setae and scales; length 2.6-2.9 mm, mean 2.8 mm, extending beyond tip of proboscis by length of palpomere 5 and part of 4. *Wing*: Length of cell R2 1.6-1.8 length of vein R2+3; length of cell M1 1.0-1.1 length of cell R2; scales fewer and smaller, particularly posteriorly. *Abdomen*: Terga same as in female but basolateral white spots smaller and sometimes

less distinct (comprised of fewer scales in loose cluster) on anterior terga (II-IV or V). Sterna as in female, tergum VIII (ventral in position) like sterna. *Genitalia* (Fig. 37): Form as figured; closely resembling those of *infula* Theobald of the Oriental Region. Ninth tergal lobe not produced, indicated by line of 3-7 (mode 6) setae. Gonocoxite rather short, lateral setae as in *poecilipes*; subapical lobe moderately prominent, part bearing setae *a* and *b* more strongly produced; setae *a* and *b* rather short and stout, *c* slender and removed from *a* and *b*, all usually hooked at tip; 4 or 5 simple setae in group *d-f*, 1 (*f*?) longer and heavier (flattened) than the others; seta *g* short and lanceolate (sometimes duplicated in specimens from the Oriental Region); *h* not distinctly differentiated, short and acuminate. Gonostylus rather short, simple, tapered distally; gonostylar claw of the usual form. Phallosome much longer than broad; aedeagal sclerite larger than lateral plate, angled ventrad, crest about as large as proximal part, proximal part with patch of minute bumps along ventral margin of mesal surface; lateral plate with strongly differentiated inner and outer divisions, inner division (= ventral arm) a laterally compressed lobe with a fuzzy covering of minute spicules, dorsocaudal angle rounded, ventrocaudal angle produced ventrad and pointed, dorsal margin with a flat laterally directed single or bilobed process (= dorsal arm?); outer division (= lateral arm) developed as a large ventrolateral winglike flap, dorsal process and dorsal articulatory process indicated by a thickened ridge. Proctiger rather long; paraproct long and narrow, basal lateral arm short and slender, crown a relatively small cluster of rather short spinelike spicules and a few small lateral blades. Cercal sclerite with 2 or 3 setae on posterolateral margin. Tergum X small.

Pupa (Fig. 37). Character and positions of setae as figured, range and modal number of branches in Table 18; well distinguished from other species of the subgenus in the region by the darkened cuticle around the bases of most setae, differs from other species of the *sitiens* group in having setae 11-CT, 3-I-III, and 1-VII normally all single. *Cephalothorax*: Lightly to moderately tanned a bright yellowish color. Setae short, all except 5,10,11-CT usually double (see table); 5-CT double or triple, more often triple; 10-CT frequently with 7 branches (5-10); 11-CT usually single, sometimes double. *Trumpet*: Moderately to heavily tanned, brown, tracheoid area darker; strongly flared, funnel-shaped, slightly bent at tracheoid area; index 4.0-5.7, mean 4.6; pinna large, about 0.4 trumpet length; tracheoid area about 0.3 trumpet length. *Abdomen*: Lightly to moderately tanned a bright yellowish color, cuticle around bases of almost all setae strongly tanned a dark brown (not shown in figure); length 3.3-3.9 mm, mean 3.6 mm; caudolateral corners of terga VII and VIII sharply produced as in *poecilipes*. Seta 7-I single to triple, 7-II single or double; 1-II single or double, aciculate; 1-III-VI moderately developed, 1-III often with 6 or 7 thin branches (6-10), branches of 1-IV-VI thicker, 1-IV very often with 4 branches (4-6), 1-V double or triple, 1-VI single or double; 1-VII single, thinner than 1-IV-VI; 5-IV-VI resemble 1-IV-VI respectively, slightly longer, about length of following tergum; 6-III-VI single, 6-III,IV relatively short and thin, 6-V,VI longer and thickened, markedly different from 6-III,IV. *Paddle*: Inner part darkened; length 0.98-1.05 mm, mean 1.02 mm, width 0.76-0.81 mm, mean 0.79 mm, index 1.3-1.4.

Larva (Fig. 38). Form and placement of setae as figured, range and modal number of branches in Table 38; bearing little resemblance to other members of the subgenus in southwestern Asia, easily recognized by the triangular dorsomentum with its minutely serrated edges and the absence of a discrete median labral plate. *Head*: Length 0.61-0.64 mm, mean 0.63 mm; width 0.90-1.02 mm, mean 0.97 mm; lightly tanned, dorsomentum and collar moderately to heavily tanned. Median labral plate indistinguishably fused to cranium. Hypostomal suture complete, extended posteriorly from posterior tentorial pit but ending well before collar. Collar large and well developed,

heavily tanned only on posterior margin. Dorsomentum an equilateral or isosceles triangle with numerous minute teeth on lateral sides. Seta 1-C long, stout, slightly swollen just beyond midlength, sharply pointed; 2-C absent; 4-C usually double (1-4); 5-C double or triple; 6-C double; 7-C distinctly shorter than 5,6-C, branches thinner (4-7); 10,15-C double or triple; 11,13-C both usually single (see table). *Antenna*: Length 0.36-0.48 mm, mean 0.41 mm; lightly tanned, distal part darker near tip; proximal part with few spicules on dorsal and ventral surfaces; seta 1-A inserted near middle, with about 19 branches (16-27); 2,3-A subapical. *Thorax*: Integument hyaline, smooth. Seta 4-P short, about half length of 1-P, usually double, sometimes single; 7-P triple; 8-P usually double (2,3), only slightly larger than 4-P. Tubercles of meso- and metathoracic pleural setal groups large and heavily tanned; seta 13-T small, with 3-6 branches. *Abdomen*: Integument like that of thorax. Dorsal and ventral setae all shorter than usual, especially 1 and 13; seta 3-I usually double (1-3), 3-II-VII usually double or triple (see table); 6-I-V normally triple (see table), 6-VI normally double; 1-III-VII normally double or triple; 13-III-V, VII usually double, sometimes triple, 13-VII seldom with 4 branches. *Segment VIII*: Comb with 5-7 (mode 6) large spinelike scales with tiny spicules on sides of expanded base. Setae 2,4-VIII normally double, 2-VIII seldom triple. *Siphon*: Index 5.01-8.35, mean 6.83; long and slender, broadest at base, sigmoid in lateral view; lightly tanned, basal rim darkened before acus. Pecten very short, confined to basal 0.1; comprised of 5-8 (mode 7) inconspicuous spines with 0-3 tiny spicules on ventral side at base. Seta 1-S in 4 pairs, widely spaced, in line, usually double or triple (see table), no longer than diameter of siphon at point of attachment; 2-S rather longer than usual, straight, stiff, darkly tanned. *Segment X*: Saddle complete; lightly tanned; smooth; length 0.38-0.45 mm, mean 0.43 mm, siphon/saddle index 3.89-5.69, mean 4.84. Seta 1-X often triple (2-4); 2-X often with 3 or 4 branches (2-5); 4-X usually in 6 pairs. Anal papillae subequal, longer than saddle.

Systematics. The concept of *bitaeniorhynchus* presented here is essentially that of Sirivanakarn (1976). This concept includes populations in southwestern Asia and Africa which Edwards (1941) and all later workers recognized under the name of *Culex ethiopicus* Edwards, 1912b. I could find no distinct differences in any stage to separate these populations from typical *bitaeniorhynchus* in the Oriental Region. The form which Edwards (1941) and later authors confused for *bitaeniorhynchus* in Africa appears to be an unnamed species related to *Culex infula* Theobald, 1901a which occurs in countries east of Pakistan. This species remains unnamed because none of the currently available material is individually reared and is inadequate for description.

Culex bitaeniorhynchus and *Taeniorhynchus ager* Giles, 1901b are objective synonyms. They are based on the same name-bearing type female which is apparently lost (Harbach, 1983). Nevertheless, there are two males in the British Museum which were labelled as types of *ager* by Theobald (1901b). These are the specimens which Edwards (1922), Bram (1967b), and Sirivanakarn (1973; 1976) used to establish the concept of "typical" *bitaeniorhynchus* in the Oriental Region. Bram (1967b) designated one of these specimens as the lectotype of *ager*. Unfortunately, these specimens have absolutely no taxonomic standing and the lectotype designation is invalid (see Harbach, 1983). But since these specimens already serve as a standard for the current application of the name of this species, the specimen bearing the invalid lectotype label of *ager* is hereby designated as the neotype of *Culex bitaeniorhynchus* Giles. This action ensures taxonomic stability and restricts the type locality to Madras, India. The neotype is identified by the following labels: "Paddy field / [two illegible marks] / 24.12.99 // Taeniorhynchus / ager / (Type). Theobald // Capt. Cornwall. / Madras. // Type // LECTOTYPE / Taeniorhynchus / ager Giles / By R. A. Bram '66"; with genitalia on an

acetate strip attached to the pin that supports the specimen.

Culex bitaeniorhynchus is widely distributed in the Afrotropical and Oriental regions. Its range also includes part of the Australian Region and the eastern part of the Mediterranean Subregion of the Palaearctic. It is possible that *bitaeniorhynchus* consists of more than one biological species, but there is no indication of geographical differentiation. The same degree of variation occurs within individual populations that occurs throughout the known range of the taxon.

Bionomics. The immature stages of *bitaeniorhynchus* occur in permanent or semipermanent bodies of standing water containing quantities of filamentous green algae (*Spirogyra*). This species apparently bites man in the Oriental Region where it is suspected of being involved in disease transmission. It has been found naturally infected with larvae of *Wuchereria bancrofti* in India (Iyengar, 1938) and *Brugia malayi* in Sri Lanka (Carter, 1948). It also is associated with Murray Valley encephalitis in Australia and with Batai virus in India (Karabatsos, 1985). Laboratory studies have shown that Japanese encephalitis virus can be transmitted transovarially (Soman and Mourya, 1985) and Sindbis virus has been isolated from populations in the Philippines and Australia (Rudnick et al., 1962; Doherty et al., 1963). Females have not been reported to bite man in southwestern Asia or Africa (as *ethiopicus* Edwards).

Distribution. *Culex bitaeniorhynchus* has a very wide distribution in the tropical and subtropical areas of Palaearctica. Populations occur in the Afrotropical Region, eastern and southern areas of the Palaearctic Region, and the Oriental and Australian regions. They occur in the southern coastal lands of southwestern Asia.

Material examined. 276 specimens. A total of 76 specimens (20 females, 18 males, 8 male genitalia, 9 pupal exuviae, 6 larval exuviae, and 15 fourth-instar larvae) were examined from southwestern Asia — IRAN: (Hajiabad, Shah-Kahoor); PAKISTAN (locations east of the Indus River): (Kahnakacha, Kasur, Lahore, Sargodha, Sattoki); P.D.R. YEMEN: (Wadi Ma'adin); YEMEN ARAB REPUBLIC: (Wadi Siham near 'Obal). Another 200 specimens (81 females, 47 males, 27 male genitalia, 3 pupal exuviae, 8 larval exuviae, and 34 fourth-instar larvae) were examined from BENIN, ETHIOPIA, GAMBIA, GHANA (including the type series of *ethiopicus*), INDIA (including the neotype), MAURITANIA, NEPAL, NIGERIA, SUDAN, TANZANIA, UGANDA, ZAIRE, ZIMBABWE, and unknown localities in Africa.

During this study 56 specimens (18 females, 13 males, 12 male genitalia, 1 pupal exuviae, 6 larval exuviae, and 6 fourth-instar larvae) representing a species previously regarded as *bitaeniorhynchus* in Africa were examined from BENIN, ETHIOPIA, GAMBIA, GHANA, SENEGAL, SUDAN, TANZANIA, UGANDA, UPPER VOLTA, ZAIRE, and ZIMBABWE.

Culex (Culex) tritaeniorhynchus Giles

tritaeniorhynchus Giles, 1901a: 606. +Holotype female: Travancore, [Madras State], India (BM).

biroi Theobald, 1905b: 82. Syntypes (male; female): Bombay, India (HNM). Synonymy with *tritaeniorhynchus* by Edwards, 1913c: 233.

summosus Dyar, 1920: 180. Holotype male: Los Banos, [Laguna, Luzon], Philippines (NMNH). Synonymy with *tritaeniorhynchus* by Bram, 1967a: 225.

siamensis Barraud and Christophers, 1931: 283. Lectotype male: Chiang Mai, Thailand; designated by Mattingly, 1956: 37 (BM). Syn-

onymy with *summosus* by Colless, 1957: 98.

Culex tritaeniorhynchus Giles of Theobald, 1901a: 364 (India, A key, M*, F*); Edwards, 1913c: 233 (Oriental Region, syn., A, tax.); Barraud, 1920: 324 (Iraq, coll. rec.); Austen, 1921: 116 (Israel, Jordan, coll. rec.); Barraud, 1923: 940 (India, L*); Buxton, 1923: 316 (Israel, Jordan, coll. rec., A, L bionomics); Barraud, 1924a: 995 (India, syn., M*, F, distr.); Kirkpatrick, 1924(1925): 367, 372 (Egypt, A, L keys); Parr, 1943: 247-251 (Syria?, Lebanon, L bionomics, A, P, L keys); Lewis, 1945: 23 (Sudan, L key); Theodor, 1952: 113 (Middle East, zoogeogr.); Dow, 1953: 689 (Iran, coll. rec., L bionomics); Gad, 1956: 136 (Egypt, distr., bionomic note); Reuben, 1969: 650 (India, A key, M*, F*, L*); Margalit et al., 1971: 323 (Israel, bionomics); El-Said and Kenawy, 1983a (Egypt); Zaini et al., 1983: 117 (Iraq, bionomic note); Kitron and Pener, 1986 (Israel, L bionomics).

Culex (Culex) thalassius Theobald of ? Abdel-Malek, 1960: 113-123 (Syria, L coll. sites, bionomics).

Culex (Culex) tritaeniorhynchus Giles of Edwards, 1921: 339 (Iraq, Israel, Jordan, A, L keys, tax., distr.); Edwards, 1926: 132 (Iraq, Israel, Jordan, A, L keys, A, L, distr.); Barraud, 1934: 404 (India, A, L keys, M*, F, L*, syn., L habitat, distr.); Séguy, 1924: 32, 186 (Iraq, Israel, Jordan, A key, M, F, L, tax., distr., syn.); Kirkpatrick, 1925: 111 (Egypt, A, P, L keys, syn., M*, F, P*, L*, distr., bionomics); Stackelberg, 1927: 157 (Middle East, M, F keys, A, M gen.*, distr.); Martini, 1931: 387 (Egypt, Iraq, Israel, Jordan, Turkey, A, L keys, M*, F, L*, distr.); Edwards, 1941: 299, 282 (Afrotropical Region, A key, M, F*, P, distr.); Monchadskii, 1951: 277 (Middle East, L key, L*, L assoc., distr.); Hopkins, 1952: 286 (L key, L, bionomics); Knight, 1953a: 232 (Yemen Arab Republic, coll. rec., L habitat, distr.); Khattat, 1955: 165 (Iraq, L*, L habitat, distr.); Mattingly and Knight, 1956: 104-137 (Oman, P.D.R. Yemen, Saudi Arabia, Socotra, Yemen Arab Republic, A, L keys, L*, distr., bionomics); Parrish, 1959: 266 (Turkey); Senevet and Andarelli, 1959: 142 (North Africa, A, P, L keys, syn., M*, F, P*, L*, distr., bionomics, med. imp.); Abdel-Malek, 1960: 113-124 (Syria, L, bionomics); Khalaf, 1962: 52 (Iraq, M, F, L, bionomics); Derwesh, 1965: 44 (Iraq); DuBose and Curtin, 1965: 352, 354 (Mediterranean area, A, L keys); Abul-hab, 1966: 281 (Iraq, distr., L bionomics); Abul-hab, 1968: 245 (Iraq, L key, L habitat, distr.); Lotfi, 1970: 402 (Iran, coll. rec.); Margalit and Tahori, 1970b: 153 (Israel, coll. sites); Aslamkhan, 1971: 155 (Pakistan); Lotfi, 1973: 206 (Iran, coll. sites); Gutsevich et al., 1974: 382 (Middle East, M, F, L keys, M*, F*, L*, distr., bionomics, med. imp.); Margalit and Tahori, 1974: 88 (Israel, coll. rec.); Lotfi, 1976: 73, 76, 82 (Iran, L key, ecol. note, L*); Sirivanakarn, 1976: 129 (Oriental Region, A, P, L keys, syn., M*, F*, P*, L*, tax., distr., bionomics, med. imp.); Ibrahim et al., 1983: 91 (Iraq, L*, key); Harbach, 1985a: 86, 97, 102 (SW Asia, Egypt, distr., A, L keys).

Adult. A rather drab species resembling *sitiens* in most respects, but readily distinguished by its smaller size, shorter cell R1 of the wing, lack of speckling on the fore- and midfemora, and the presence of ventral pale scaling proximal to the median pale ring of the proboscis.

FEMALE. *Head:* Antenna dark, pedicel yellowish to light brown; length 1.2-1.9 mm, mean 1.5 mm. Proboscis dark-scaled with narrow median pale ring, ring 0.15-0.20 proboscis length, proximal margin of ring about 0.45 from base; proximal part of proboscis usually with scattered pale scales above and proximal extension of median pale ring below (extension of ring often weak or absent in middle leaving an isolated spot

proximal to ring), sometimes giving appearance of a second pale ring; labella yellowish; length 1.4-1.7 mm, mean 1.6 mm. Maxillary palpus dark-scaled, pale scales at apex of palpomere 4; length about 0.3 mm, about 0.2 length of proboscis. Forked scales of vertex dirty yellow to brown, darker posteriorly and laterally, nearly linear anteriorly; falcate scales pale yellow, long and relatively narrow; lateral spatulate scales yellowish white, rather broad above, narrower below. *Thorax*: Integument reddish brown to brown. Scutum with shiny golden-brown falcate scales, with paler scales on anterior promontory, prescutellar area and often on lateral margin of fossa and supraalar area. Scales of scutellum same as prescutellar scales. Anteprenotum with some pale to dirty yellow falcate scales confined largely to anterior area, with 2 more or less distinct rows of setae; postpronotum with fine falcate scales more or less same color as scutal scales, with 3-5 setae in vertical row on posterior margin. Pleura with pale scales as follows: proepisternum with small patch of narrow spatulate scales below and mesal to upper proepisternal setae; mesokatepisternum with rather small patches of spatulate scales on upper corner and lower posterior border at level of katepimeron; mesepimeron with small anterior patch of spatulate scales adjacent to upper katepisternal scales, and sometimes with few near linear or fusiform scales among upper mesepimeral setae. Pleural setae: 5-7 upper proepisternal, 4-9 prealar, 3 or 4 upper mesokatepisternal, 7-10 lower mesokatepisternal, 5-9 upper mesepimeral, and no lower mesepimeral. *Wing*: Length 2.6-3.4 mm, mean 2.9 mm; length of cell R2 2.6-3.4 length of vein R2+3, mean 2.9; length of cell M1 0.8-0.9 length of cell R2; dark-scaled with short line of pale scales at base of costa, pale line often weakly developed or absent; dorsal surface with spatulate scales on costa, subcosta, R and R1, R3, M3+4 and CuA, dorsal surface of other veins with long linear scales; ventral surface with linear scales on all veins except costa and subcosta. *Halter*: Pale with distal part of scabellum and base of capitellum usually dark-scaled, capitellum sometimes largely dark-scaled. *Legs*: Forecoxa always with pale scales at base, rest of scales either entirely dark, dark proximally and pale distally, or with dark and pale scales mixed, frequently with few narrow pale scales posterolaterally at apex; midcoxa with vertical patch of pale scales on anterior side of lateral midline and small patch of dark scales distally on anterior surface; hindcoxa with vertical line of indistinct pale scales on anterior side of lateral midline. Trochanters each with small patch of dark scales on posteroventral surface. Forefemur largely dark-scaled, poorly contrasted but darker anteriorly than posteriorly, with narrow rather indistinct knee spot; midfemur dark-scaled anteriorly, pale-scaled posteriorly and ventrally, dark and pale areas better contrasted than on forefemur, dark area forming narrow band at apex, with very indistinct knee spot; hindfemur pale-scaled with variable, often indefinite, anterodorsal dark stripe that abruptly widens distally to form more or less distinct narrow apical band, with very narrow knee spot. Foretibia dark-scaled dorsally (darker than femur), pale-scaled ventrally, with narrow dorsal pale spot at apex; midtibia dark-scaled anteriorly, pale-scaled posteriorly, with faint indication of pale scaling at apex, particularly on anterior surface; hindtibia dark-scaled dorsally, pale-scaled ventrally, with indistinct dorsal pale spot at apex and indication of dorsal pale spot at base. Tarsi with narrow, indistinct basal and apical pale rings on tarsomeres 1-4; if pale ring present on apex of midtarsomere 4, then pale ring usually also evident at base of midtarsomere 5; rings between midtarsomeres 3-4 and 4-5 often absent. *Abdomen*: Tergum I with median posterior patch of dark scales; terga II-VII with narrow, slightly convex basal pale bands (0.15-0.35 tergum length) and basolateral pale spots that become larger in progression from anterior to posterior terga, tergum VII often with median posterior patch of pale scales; tergum VIII largely pale-scaled with narrow apical dark band. Sterna pale-scaled, frequently with dark scales on posterolateral corners; sternum VIII with lateral patches of

pale scales, without scales medially.

MALE. Like female except as follows. *Head:* Proboscis with ventral cluster of setae on proximal side of false joint. Maxillary palpus extending beyond tip of proboscis by at least length of palpomere 5, length 1.8-2.8 mm, mean 2.4 mm; palpomere 3 with subapical stripe of pale scales on dorsal and lateral surfaces, often only subapical line on lateral surface, ventromesal margin with short setae in row extending length of pale scaling, ventral surface with long setae distal to pale scaling; palpomeres 4 and 5 each with narrow basal ring of pale scales and numerous long ventrolateral setae, basal rings actually very narrowly broken on lateral and mesal margins by row of setae, palpomere 5 also usually with some pale scales dorsally at apex. Forked scales of vertex broader and somewhat shorter. *Wing:* Length 2.2-3.2 mm, mean 2.8 mm; length of cell R2 1.6-2.7 length of vein R2+3, mean 2.2; scaling same as in female but scales smaller and less dense, spatulate scales not as short and broad. *Abdomen:* Basal pale bands of terga generally slightly broader, 0.22-0.40 tergum length. *Genitalia* (Fig. 39): Form as figured; very much as in *sitiens* and *mimeticus*. Ninth tergal lobe with row of 3-10 (mode 6) setae. Gonocoxite with 3 or 4 rows of lateral setae extending from just above subapical lobe to point about midway between subapical lobe and base of gonocoxite; subapical lobe with 3 setae in group *d-e*, all flattened and hooked, 2 with subapical denticles, *f* flattened and broad, broadest distally. Inner division of phallosome with 3-5 (mode 4) caudally curved teeth. Proctiger not unusual; paraproct with slightly larger basal lateral arm, smaller crown, and well developed ventral acetabulum. Cercal sclerite usually with 2 setae (1-4) on posterolateral corner.

Pupa (Fig. 39). Form and placement of setae as figured, range and modal number of branches in Table 19; different from other members of the *sitiens* group in southwestern Asia in having setae 8-CT and 1-II more branched. *Cephalothorax:* Lightly tanned. Setae 1-3-CT usually triple (see table); 4,7,11-CT double, 4-CT rarely single; 8-CT shorter and more branched than usual, same length as 9-CT, with 6 or 7 branches; 9-CT usually double (2,3); 12-CT longer than 10,11-CT, usually with 4 or 5 branches (3-5). *Trumpet:* Dark and rather short; index 5.88-6.25, mean 6.04; pinna 0.2-0.3 trumpet length. *Abdomen:* Lightly tanned; length 2.19-2.42 mm, mean 2.32 mm. Seta 7-I usually with 3 or 4 branches (2-5), 7-II usually double or triple (2-4); 1-II-VII and 6-III-VI tend to be more branched than usual, especially 1-II (see table); 1-III-VII about length of tergum following; 5-IV multiple, different in appearance from 5-V,VI which are double with heavier and longer branches; 6-V,VI developed like 6-III,IV but distinctly longer; 4-VIII with 3 or 4 branches. *Paddle:* Pale; length 0.66-0.77 mm, mean 0.70 mm, width 0.46-0.54 mm, mean 0.51 mm, index 1.3-1.5, mean 1.4.

Larva (Fig. 40). Character and positions of setae as figured, range and modal number of branches in Table 39; resembling members of the *pipiens* group, but differing conspicuously in the character of seta 1-C and the pecten spines; more closely resembling *sitiens* than other members of the *sitiens* group occurring in southwestern Asia, but easily distinguished by the characters given in the key. *Head:* Length 0.68-0.78 mm, mean 0.72 mm; width 1.03-1.11 mm, mean 1.07 mm; lightly to moderately tanned, darker behind eyes, collar moderately to heavily tanned, dorsal apotome with variable number of moderately tanned spots distributed somewhat as in *pipiens*. Hypostomal suture complete, extended to collar from posterior tentorial pit. Dorsomentum with 6-9 teeth (mode 7) on either side of center. Seta 1-C tapered, sharply pointed, dark; 2-C absent; 5-C normally triple (3,4); 6-C normally double (2,3); 7-C with 5-10 branches, about as long as 5,6-C; 10,12,13-C usually triple (2-4); 11-C double. *Antenna:* Length 0.52-0.58 mm, mean 0.55 mm; tanning and spiculation as in *sitiens*. Seta 1-A with about 24 branches (21-35); 2,3-A subapical. *Thorax:* Integument

normal. Seta 4-P double; 7-P normally triple (2,3), slightly longer than 4-P; 8-P double, weaker than 4-P. Seta 1-M single, longer than 2-M; 2-M multiple (4-8); 4-M usually triple (2,3); 5-M shorter than usual. Seta 1-T single, not more than 0.5 length of 2-T; 2-T double or triple; 13-T with 7-11 branches, not much longer than 12-T. *Abdomen*: Integument normal. Seta 3-I,II,IV usually triple (2,3), 3-I,II rarely with 4 branches; 3-III commonly double (2,3), 3-V single or double, 3-VII with 4-6 branches, often with 5; 6-I,II normally triple (2,3), 6-II shorter than 6-I; 6-III-VI usually double (2,3), 6-III,VI same length as 6-II, 6-IV,V shorter; 7-I most often double (1-3); 1-III-VII about 0.5 length of segment, 1-III most often triple (2-4), 1-IV,V with 4 branches, 1-VI most often with 4 branches (3-6), 1-VII usually with more than 4 branches (4-7); 13-III-V resemble 1-III-V but usually with more branches (see table). *Segment VIII*: Comb with 26-60 (mode 38) evenly fringed scales. *Siphon*: Index 5.77-7.00, mean 6.30; moderately tanned, slightly darker at apex, basal ring and acus darker. Pecten of 12-18 (mode 14) spines with ventral row of denticles, larger spines with 7-12 denticles. Seta 1-S normally in 6 pairs, occasionally in 5 or 5.5 pairs, 1 subapical pair (1e-S) borne laterally, others borne posterolaterally, 3 proximal pairs (1a,b,c-S) commonly with 4 branches (2-6), 3 distal pairs (1d,e,f-S) most often triple (2-4), only slightly shorter than proximal pairs, all a little longer than diameter of siphon at point of attachment. *Segment X*: Saddle complete; lightly to moderately tanned, darker posterodorsally; with conspicuous spicules posteriorly; length 0.29-0.36 mm, mean 0.33 mm, siphon/saddle index 4.23-6.14, mean 4.73. Seta 1-X often triple (2-4); 2-X usually with 3 or 4 branches, seldom double; 4-X usually in 6 pairs, an additional unpaired seta occasionally present. Anal papillae elongate, subacutely tapered, about as long as saddle.

Systematics. This and the next species are members of the complicated *vishnui* subgroup of Bram (1967b). The group is almost wholly Oriental, but some members also occur in adjacent areas. *Culex tritaeniorhynchus* and *pseudovishnui* are the only members of the group which occur in southwestern Asia. *Culex tritaeniorhynchus* is common throughout the area and many coastal countries of Africa.

Culex tritaeniorhynchus should not be confused with any other species in southwestern Asia except *pseudovishnui*. It is readily differentiated from this species by the development of the comb scales and pecten spines of the larva. The pupa differs in the character of setae 8-CT and 1-II and the posterolateral corners of tergum VIII. There is considerable overlap in the adults, but specimens of *tritaeniorhynchus* usually can be recognized relatively easily by the more extensive ventral pale scaling of the proboscis. The male genitalia are very nearly congruent, differing essentially only in the size of the teeth of the inner division of the phallosome.

Culex tritaeniorhynchus is a peculiar species which, as pointed out by Sirivanakarn (1976), is similar to members of the *barraudi* subgroup in the larval stage. This situation parallels that of *poecilipes* and *whitmorei* which are included as members of the *sitiens* subgroup in spite of conspicuous larval disparity. It is apparent that the present system of grouping species of the *sitiens* group does not accurately reflect species affinities based on all life stages. This group more than any other in the subgenus *Culex* brings to mind Belkin's (1962) contention that hybridization seems to have been an important mechanism of speciation in mosquitoes.

Bionomics. *Culex tritaeniorhynchus* is a common species in southwestern Asia. The immature stages are typically found in rice fields, flood waters, and marshy areas with floating or emergent vegetation. They also are found in ponds, swamps, streams, springs, irrigation ditches, grassy pools, seepages, and animal hoofprints. The water may be fresh or slightly brackish but is always clear and clean.

Females of *tritaeniorhynchus* are known to enter dwellings and bite man during

any time at night (Kirkpatrick, 1925; Khalaf, 1962). In Iran and Iraq, *tritaeniorhynchus* is considered to be a vector of Japanese encephalitis virus (Travis and Labadan, 1967). The susceptibility and transmission efficiency for West Nile virus in the laboratory indicate that *tritaeniorhynchus* is an excellent potential vector of this pathogen in Pakistan (Hayes et al., 1980). A single isolation of Sindbis virus was made from a pool of specimens collected at Al Khobar, Saudi Arabia (Wills et al., 1985). This species has been associated with various viruses and filarial pathogens in many areas of eastern and southeastern Asia.

Distribution. *Culex tritaeniorhynchus* occurs in eastern Asia, the Oriental Region, southwestern Asia, and Africa.

Material examined. 570 specimens. A total of 536 specimens (221 females, 137 males, 69 male genitalia, 23 pupal exuviae, 40 larval exuviae, and 46 fourth-instar larvae) were examined from southwestern Asia — IRAN: (Aliabad, Basra, Cham Asbi, Chomaisaray, Hassan Kiadeh, Kanroud, Karken River, Sabzab, Shour River, Zahedan, Zarjub); IRAQ: Basrah, Galala, Magil, Rawasnduz, Tal A'far, Thallal); ISRAEL: (Beisan, Galilee, Khirbet Hadrah, Neot Hokikar); JORDAN: (Yabes); OMAN: (Salalah); PAKISTAN (including localities east of the Indus River): (Balloki, Kasur, Khulna, Lahore, Peshawar); P.D.R. YEMEN: (Bateis, Dis Town, Hami, Mukalla, Urfat Subai); SAUDI ARABIA: (Alajam, Al Khobar, Al Qatif, Dhahran, Saihat); TURKEY: (Adana, Silifke). An additional 34 specimens (19 females, 6 males, 5 male genitalia, and 4 fourth-instar larvae) were examined from BANGLADESH, ETHIOPIA, INDIA (the holotype female), KENYA, SOCOTRA, and unknown localities.

Culex (Culex) pseudovishnui Colless

pseudovishnui Colless, 1957: 88. Holotype female: Singapore (BM).
neovishnui Lien, 1968: 230. Holotype male: Peiyuan, Tungho, Taitung, Taiwan (TMRI). Synonymy with *pseudovishnui* by Sirivanakarn, 1976: 116.

Culex pseudovishnui Colless of Reuben, 1969: 648 (India, M*, F*, L*, A key); Zaim and Cranston, 1984: 179 (Iran, L, coll. sites).

Culex (Culex) pseudovishnui Colless of Aslamkhan, 1971: 155 (Pakistan); Sirivanakarn, 1976: 116 (Oriental Region, M*, F, P*, L*, syn., distr., bionomics, med. imp.); Harbach, 1985a: 86, 97, 107 (Iran and Pakistan only, distr., A, L keys).

Culex vishnui Theobald of Barraud, 1923: 938 (India, L*); Barraud, 1924a: 996 (in part; India, A key, syn., M*, F, distr.).

Culex (Culex) vishnui Theobald of Edwards, 1921: 339 (Iraq, A key, bionomics, distr.); Edwards, 1926: 132 (Iraq, A, L, keys, A, distr.); Séguy, 1924: 30, 186 (Iraq, A key, M, F, L, tax., distr., syn.); Stackelberg, 1927: 158 (in part; S. Asia, M, F keys, A, M gen.*, distr.); Martini, 1931: 392 (in part; S. Asia, A, L keys, M*, F, L*); Barraud, 1934: 400 (in part; India, A, L keys, M*, F, L*, syn., L habitat, distr.); ? Monchadskii, 1951: 284 (in part; S. Asia, L key, L*, bionomic note, distr.); Khalaf, 1962: 55 (Iraq, A, M gen., L); Abul-hab, 1968: 246 (Iraq); Lotfi, 1973: 206 (Iran, bionomics, distr., coll. sites); Gutsevich et al., 1974: 371 (in part; S. Asia, L key); Lotfi, 1976: 72, 78, 79 (Iran, L key, ecol. note, L*).

Adult. A small brown species closely resembling *tritaeniorhynchus*, but the median pale ring of the proboscis is not extended proximally on the ventral surface and

there is often an indefinite anterior pale stripe on the hindtibia. The proboscis of the male may have one or two short setae at the base of the median pale ring but is without a distinct ventral cluster of setae.

FEMALE. *Head:* Pedicel of antenna yellowish laterally, mesal surface dark brown with some tiny inconspicuous scales; flagellum normal, dark, length about 1.8 mm. Proboscis length 1.5-1.8 mm, mean 1.7 mm; dark brown to blackish-scaled with median pale ring of cream-colored scales 0.40-0.65 from base. Maxillary palpus dark-scaled with few pale scales at apex; length about 0.3 mm, approximately 0.2 proboscis length. Vertex with whitish to pale golden falcate scales, paler along margin of eye, sometimes darker laterally; forked scales white to yellow in middle, dark brown to black posterolaterally; lateral spatulate scales white, or nearly so. Interocular space with few scales, same color as ocular scales. Ocular setae golden brown to brown, often paler near middorsal line of cranium; 2 golden interocular setae project ventrally over clypeus. *Thorax:* Scutal integument brown; pleural integument yellowish brown or paler, with dark brown areas on proepimeron, anterior margin of mesokatepisternum, postspiracular area, prealar area, between upper and lower mesokatepisternal scale-patches, below anterior mesepimeral scales and on upper portion of mesepimeron. Scutal scales rather long and narrow, usually predominantly pale, color ranging from silvery white to golden, frequently pale golden with whitish scales along margins and on prescutellar area; darker scales, when present, either indistinct or distinct, occurring on acrostichal, median scutal fossal and/or posterior dorsocentral areas, usually golden brown. Scutal setae dark brown with reddish and/or golden sheen. Lobes of scutellum with scales resembling prescutellar scales; each lateral lobe with 3-5 large setae, median lobe with 5-7. Anteprenotum with brown setae, some paler, often yellowish, ventrally; with whitish to pale golden falcate scales, coarser and paler ventrally. Postpronotum with whitish to pale golden falcate scales on about dorsal 0.5, slightly coarser and paler posteriorly; with 5 or 6 dark setae on posterodorsal margin. Pleural setae yellow to brownish yellow: 4-6 proepisternal, 8 or 9 prealar, 4 or 5 upper mesokatepisternal, 7 or 8 lower mesokatepisternal, 4 or 5 upper mesepimeral; lower mesepimeral seta absent. Pleura with the usual patches of elongate white spatulate scales: small patch below proepisternal setae, patches on upper corner and lower posterior margin of mesokatepisternum, anterior patch on mesepimeron at level of upper patch on mesokatepisternum, and small patch before upper mesepimeral setae; upper proepisternal and upper mesepimeral patches usually with only 2 or 3 scales, or sometimes absent. *Wing:* Length 2.8-3.2 mm, mean 3.0 mm; length of cell R2 1.5-2.8 length of vein R2+3, mean 2.3; length of cell M1 0.8-0.9 length of cell R2; scales predominantly dark, with variable amount of pale scaling on costa, subcosta, R and R1, pale scales always present on posterior side of costa near humeral crossvein. *Halter:* Integument and scales entirely pale. *Legs:* Anterior surface of forecoxa entirely white-scaled or with variable amount of black scaling in middle, most often with black scales; midcoxa with longitudinal patch of white scales on anterior side of midlateral row of strong setae; hindcoxa with longitudinal patch of white scales on anterolateral surface, posterolateral surface with irregular row of strong setae. Lateral surfaces of trochanters without scales, other surfaces white-scaled, anterior surface of foretrochanter sometimes with dark scales. Apices of all femora with narrow white knee spots; anterior surface of forefemur brown-scaled, posterior surface white-scaled; midfemur like forefemur but brown scaling gradually expanded over dorsal surface toward apex and white scaling sometimes expanded over ventral surface onto lower part of anterior surface; hindfemur mainly white-scaled, with anterodorsal stripe of brown scales, stripe gradually spreading over dorsal surface distally and then abruptly expanded onto anterior and posterior surfaces near apex. Foretibia whitish-scaled with

complete dorsal stripe of brown scales; midtibia mainly whitish-scaled, ventral surface with complete stripe of brown scales, dorsal surface with narrow, usually obscure brown stripe that is largely obsolescent in middle; hindtibia mainly brown-scaled, narrowly pale at base and apex, often with ill-defined anterior and posterior stripes of whitish scales usually not reaching ends of tibia and normally joined ventrally for most or part of their length. Tarsi with narrow pale basal bands on tarsomeres 1-3, frequently on 4, and occasionally on 5; tarsomeres 1 and 2 also frequently with very narrow pale apical bands; posterior surface of tarsomere 1 usually pale-scaled. *Abdomen*: Tergum I with posteromesal patch of blackish scales; terga II-VII mainly clothed in dark brown to blackish scales, with basolateral patches of white scales, tergum II with basomedian spot of pale scales; terga III-VII with straight or convex basal bands of white or nearly white scales, bands usually about 0.25 tergum length but often narrower and sometimes not reaching basolateral pale patches, particularly on more anterior terga; tergum VIII usually with broad basal pale band and narrow apical dark band. Sterna II-VII mainly pale-scaled with large apicolateral dark patches, dark patches sometimes more or less joined mesally, particularly on more posterior sterna; sternum VIII with lateral pale patches, broad median area devoid of scales.

MALE. Resembling female except for following sexual differences. *Head*: Proboscis with narrow pale band about 0.50 to 0.65 or 0.70 from base, sometimes with 1 or 2 long setae ventrally at base of band; false joint inconspicuous. Maxillary palpus with bands of pale scales and/or pale integument on about distal 0.5 of palpomere 2, middle of palpomere 3, bases of palpomeres 4 and 5 and apex of palpomere 5; ventrolateral margin of palpomere 3 with 10-20 long dark setae at apex; ventromesal margin with complete row of short, translucent, antrorsely curved, scalelike setae that increase progressively in length from base to apex of palpomere; lateral and mesal surfaces of palpomeres 4 and 5 densely setose; longer than proboscis by length of palpomere 5 and part of 4. *Thorax*: Scutal scales finer, more uniformly colored. *Wing*: Length of cell R2 1.5-2.1 length of vein R2+3, mean 1.8; subcosta intersects costa before furcation of R2+3. *Abdomen*: Terga II-VII without basolateral pale patches; basal bands of terga III-VII broader, usually 0.30-0.45 tergum length, bands usually straight or nearly so, those of terga VI and VII produced posteriorly along lateral scale-free areas; tergum VII sometimes with pale scales apically in middle; tergum VIII (ventral in position) with approximately basal 0.5 pale-scaled. Sterna II-VII with dark apical bands that are broadest in middle, sometimes with few pale scales centrally on posterior border; sternum VIII (dorsal in position) like tergum VIII of female but sometimes with pale scales along posterior margin. *Genitalia* (Fig. 41): Form as figured; constructed as in *sitiens*, *mimeticus*, and *tritaeniorhynchus*. Ninth tergal lobe with row of 3-7 (mode 4) short setae. Gonocoxite and phallosome closely resembling those of *tritaeniorhynchus*, inner division of phallosome differs in having distinctly larger teeth (4 or 5, mode 5) and the dorsocaudal angle usually notched. Proctiger as in *tritaeniorhynchus*; cercal sclerite with 2 or 3, usually 2, setae on posterolateral corner.

Pupa (Fig. 41). Character and positions of setae as figured, range and modal number of branches in Table 20; similar to *tritaeniorhynchus*, distinguished by setae 8-CT and 1-II with fewer branches and posterolateral angle of tergum VIII acute. *Cephalothorax*: Lightly tanned. Seta 2-CT usually with 3 or 4 branches, more often with 4 (3-5); 8-CT with 3-5 branches, distinctly longer than 9-CT; 12-CT about as long as 10,11-CT, usually triple (2-5). *Trumpet*: Moderately tanned, tracheoid area darker; index 5.45-8.10, mean 6.61; pinna 0.15-0.35 trumpet length. *Abdomen*: Lightly tanned; length 2.34-2.96 mm, mean 2.69 mm. Seta 7-I usually double (2-4); 1-II-VII distinctly shorter than tergum following; 6-III-VI commonly with 4 or 5 branches (see table), all

about same length; 5-IV shorter and 5-V,VI about the same as in *tritaeniorhynchus*; 4-VIII usually double or triple (2-4). *Paddle*: Very lightly tanned; length 0.72-0.83 mm, mean 0.75 mm, width 0.47-0.56 mm, mean 0.53 mm, index 1.4-1.6, mean 1.4.

Larva (Fig. 42). Form and placement of setae as figured, range and modal number of branches in Table 40; distinct from *sitiens*, *tritaeniorhynchus*, and members of the *pipiens* group in southwestern Asia in the character of the comb scales, easily distinguished from other members of the *sitiens* group in the region by the characters given in the key. *Head*: Length 0.71-0.88 mm, mean 0.76 mm; width 1.08-1.22 mm, mean 1.16 mm; lightly tanned, darker posteriorly. Dorsomentum heavily tanned; teeth large and distinct, 5-7 (mode 6) on either side of center. Seta 1-C long, relatively slender, tapered, dark; 2-C absent; 5-C usually triple (2-4); 6-C usually double (1-3); 7-C often with 8 or 9 branches (8-12), about as long as 5,6-C; 10-C with 3 or 4 branches on short stem; 11,13-C usually double (1-3); 12-C frequently double but often more branched (2-5). *Antenna*: Length 0.60-0.71 mm, mean 0.66 mm; tanning and spiculation as usual. Seta 1-A with about 30 branches (27-30); 2,3-A distinctly subapical. *Thorax*: Integument hyaline, with rather distinct thumbprint pattern, lateral surfaces and dorsal surface anteriorly with minute spicules. Seta 4-P normally double (1-3), nearly as long as 7-P; 7-P triple; 8-P normally double (1,2). Seta 1-M single or double in nearly equal frequencies; 4-M usually triple (2,3). Seta 1-T single or double, much shorter than 2-T; 2-T double or triple; 13-T often with 9 or 10 branches (7-12), not much longer than 12-T. *Abdomen*: Hyaline, thumbprint pattern evident. Seta 3-I variable, with 3-7 branches, most often with 3; 3-II-IV usually double or triple, 3-II,III occasionally with 4 branches; 3-V usually single (1,2); 3-VII with 3-7 branches; 6-I,II triple, 6-III-VI usually triple (see table), 6-I distinctly longer than the others, 6-III,IV not much shorter than 6-II,V,VI; 7-I single; 1-III-VII slightly longer than 0.5 length of tergum, 1-III,IV frequently with 5 or 6 branches, 1-V,VI often with 6 or 7 and 1-VII often with 7 or 8 (see table). *Segment VIII*: Comb with 5-10 (mode 6) scales developed as in *poecilipes* and *bitaeniorhynchus*. *Siphon*: Index 4.41-6.87, mean 5.40; lightly tanned, basal rim dark; surface with rows of minute vesicles; very slightly bent forward before apex. Pecten composed of 8-12 (mode 11) large distally curved spines with complete ventral row of denticles. Seta 1-S in 6.5, 7 or 7.5 pairs, middle pair (1d-S) borne laterally, others borne posterolaterally; most proximal pair (1a-S) 1.5-2.0 times as long as diameter of siphon at point of attachment, others gradually shorter toward tip of siphon, most distal pair (1g-S) no longer than diameter of siphon at point of attachment. *Segment X*: Saddle lightly tanned, with prominent spicules on posterodorsal margin; length 0.36-0.42 mm, mean 0.38 mm, siphon/saddle index 3.13-4.29, mean 3.61. Seta 1-X with 3 or 4 branches; 2-X usually triple (2,3); 4-X in 6 pairs, often with 7-9 branches. Anal papillae rather slender, longer than saddle.

Systematics. This species has been confused in the past with *Culex vishnui* Theobald, 1901a, which is mainly restricted to the Oriental Region and occurs no farther west than eastern India. Although *pseudovishnui* closely resembles *vishnui*, it is definitely a distinct species which is well differentiated in the larval stage. Zaim and Cranston (1984) corrected the previous record of *vishnui* in Iran on the basis of larval characters. All life stages from populations in southwestern Asia seem to agree in all essential respects with *pseudovishnui* in the Oriental Region, but too few specimens are currently available for a detailed comparative study.

To my knowledge, *pseudovishnui* has never been recorded from Afghanistan. My previous report (Harbach, 1985a) was in error, but the species probably occurs there because it has been collected very near its borders in both Iran and Pakistan.

Culex pseudovishnui is very similar to *tritaeniorhynchus* in the adult stage, and

the two forms are often difficult to differentiate. The most reliable characters that will separate the females of these forms are the less extensive pale scaling of the proboscis and the shorter vein R2+3 in *pseudovishnui*. The male genitalia cannot be differentiated with absolute certainty even though the teeth of the inner division of the phallosome are definitely larger in this species. The larvae are strikingly different in the form of the comb scales and pecten spines, and the pupae differ in the development of setae 8-CT and 1-II and in having more acute posterolateral corners on tergum VIII.

Bionomics. This species breeds in permanent standing water and transient ground pools. Larvae are commonly found in rice fields, ditches, stream margins, marshes, and ponds in association with *tritaeniorhynchus* and *bitaeniorhynchus*. Females are attracted to birds, pigs, and other domestic animals and occasionally bite man (Colless, 1959; Reuben 1971a,b). *Culex pseudovishnui* is a potential vector of Japanese encephalitis virus and has been associated with Kunjin and Tembusu viruses in Southeast Asia (Karabatsos, 1985).

Distribution. *Culex pseudovishnui* is widely distributed in the Oriental Region and occurs in Japan, Korea, China, Pakistan, and Iran.

Material examined. 73 specimens. Only 38 specimens (6 females, 7 males, 7 male genitalia, 2 pupal exuviae, 7 larval exuviae, and 9 fourth-instar larvae) were examined from southwestern Asia — IRAN: (Shemian, Zahedan); PAKISTAN (including localities east of the Indus River): (Kohat, Lahore, Peshawar, Sargodha, Wahga). Another 35 specimens (17 females, 10 males, 5 male genitalia, and 3 pupal exuviae) were examined from INDIA.

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FIGURE 1

Map of southwestern Asia and Egypt

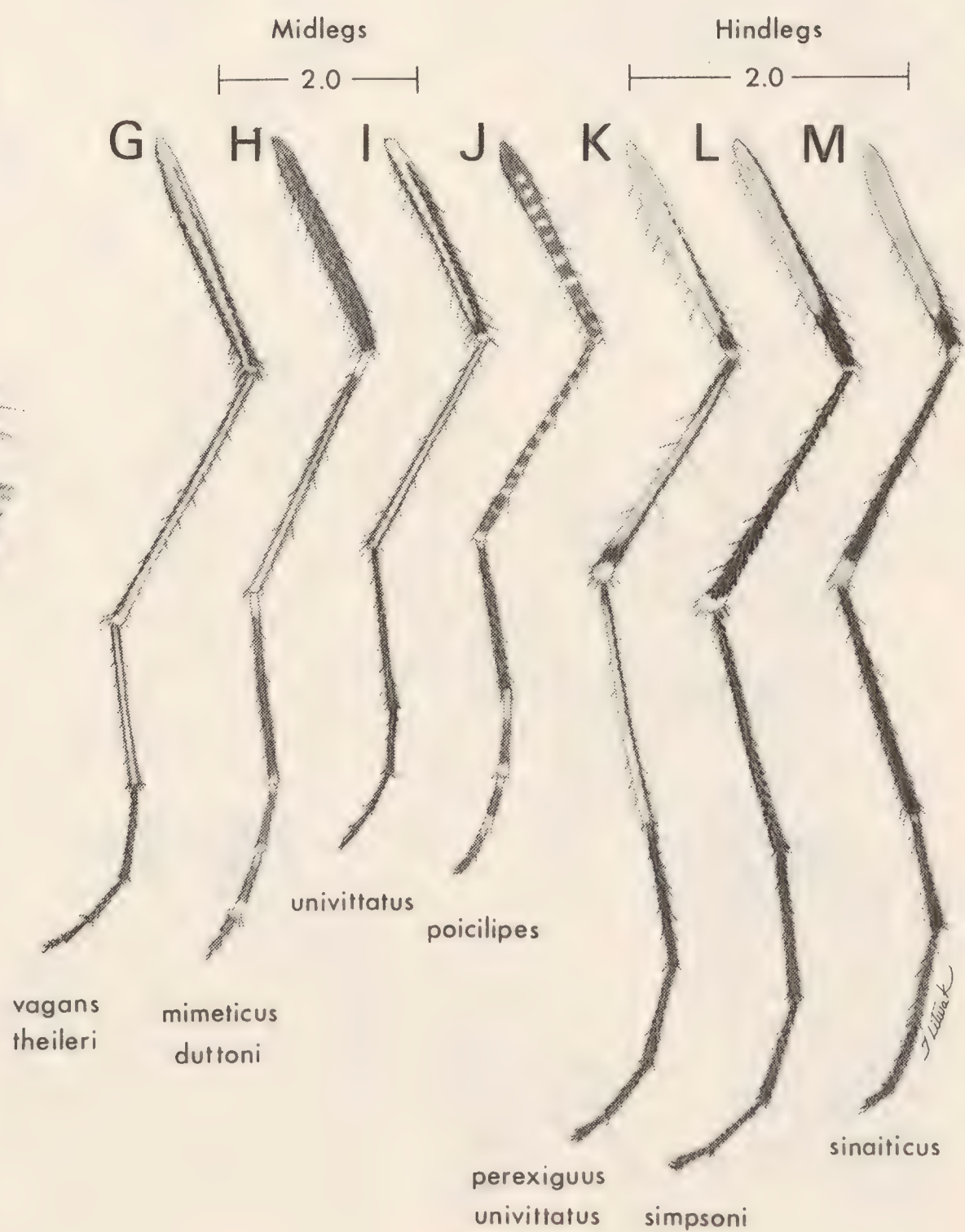
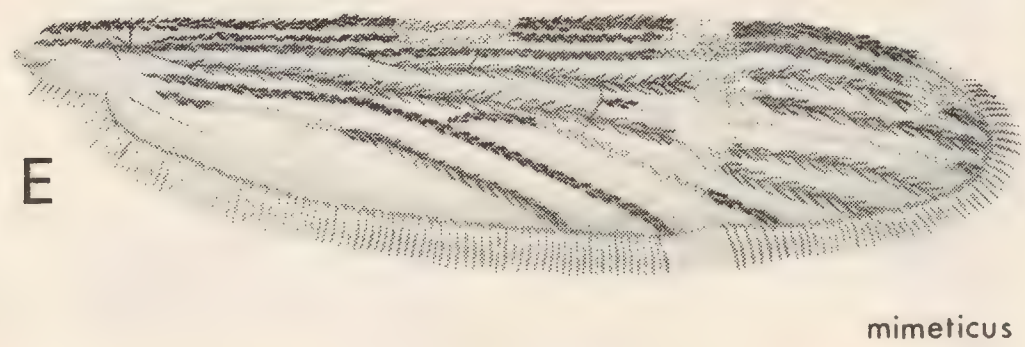
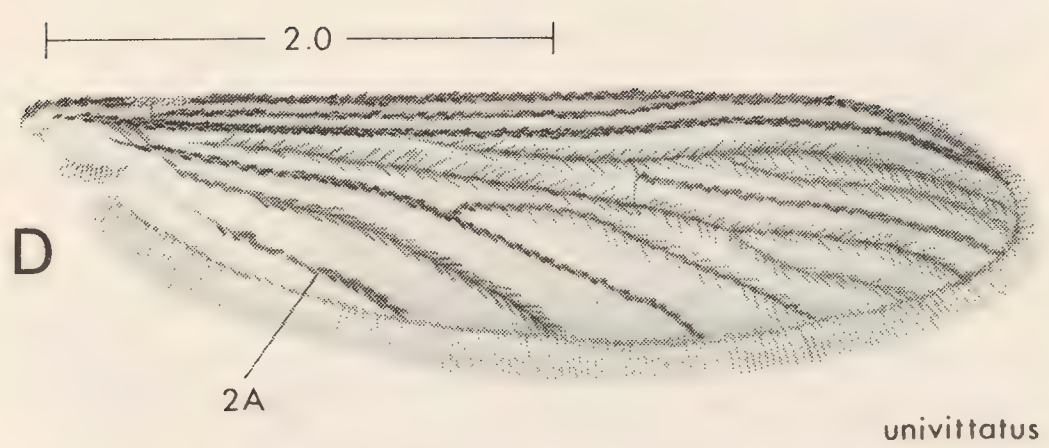
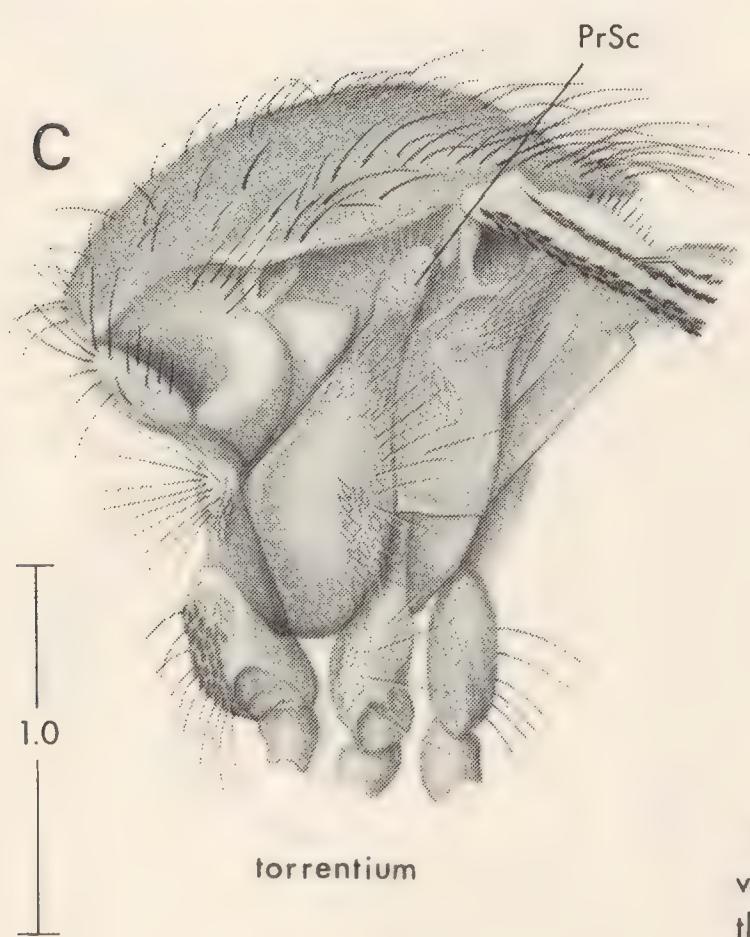
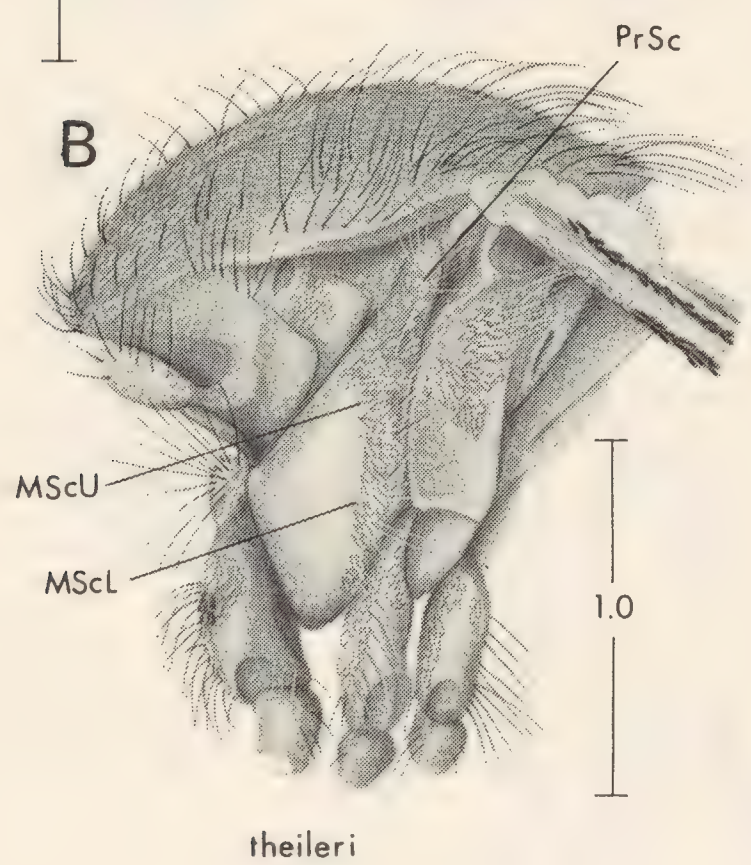
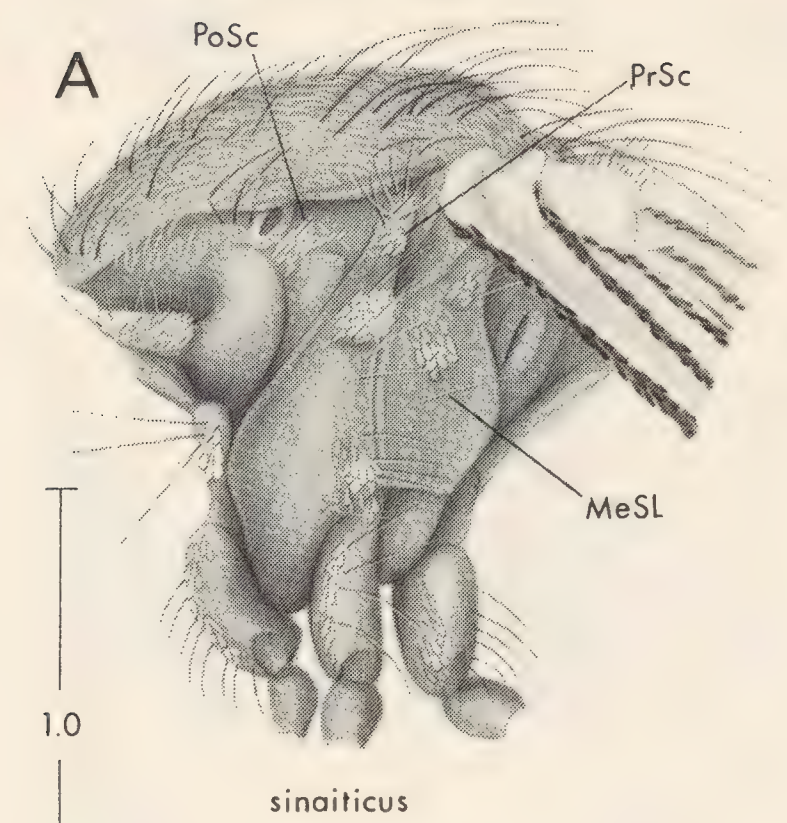
Fig.1



FIGURE 2**Some Adult Vestiture**

- A-C. Thoraces, lateral (left) aspects. MeSL = lower mesanepimeral seta; MScL = lower mesokatepisternal scales; MScU = upper mesokatepisternal scales; PoSc = post-spiracular scales; PrSc = prealar scales.
- D-F. Wings, dorsal aspects of right wings. 2A = vein 2A.
- G-J. Midlegs, anterior aspects.
- K-M. Hindlegs, anterior aspects.

Fig.2



Culex (Culex) pipiens

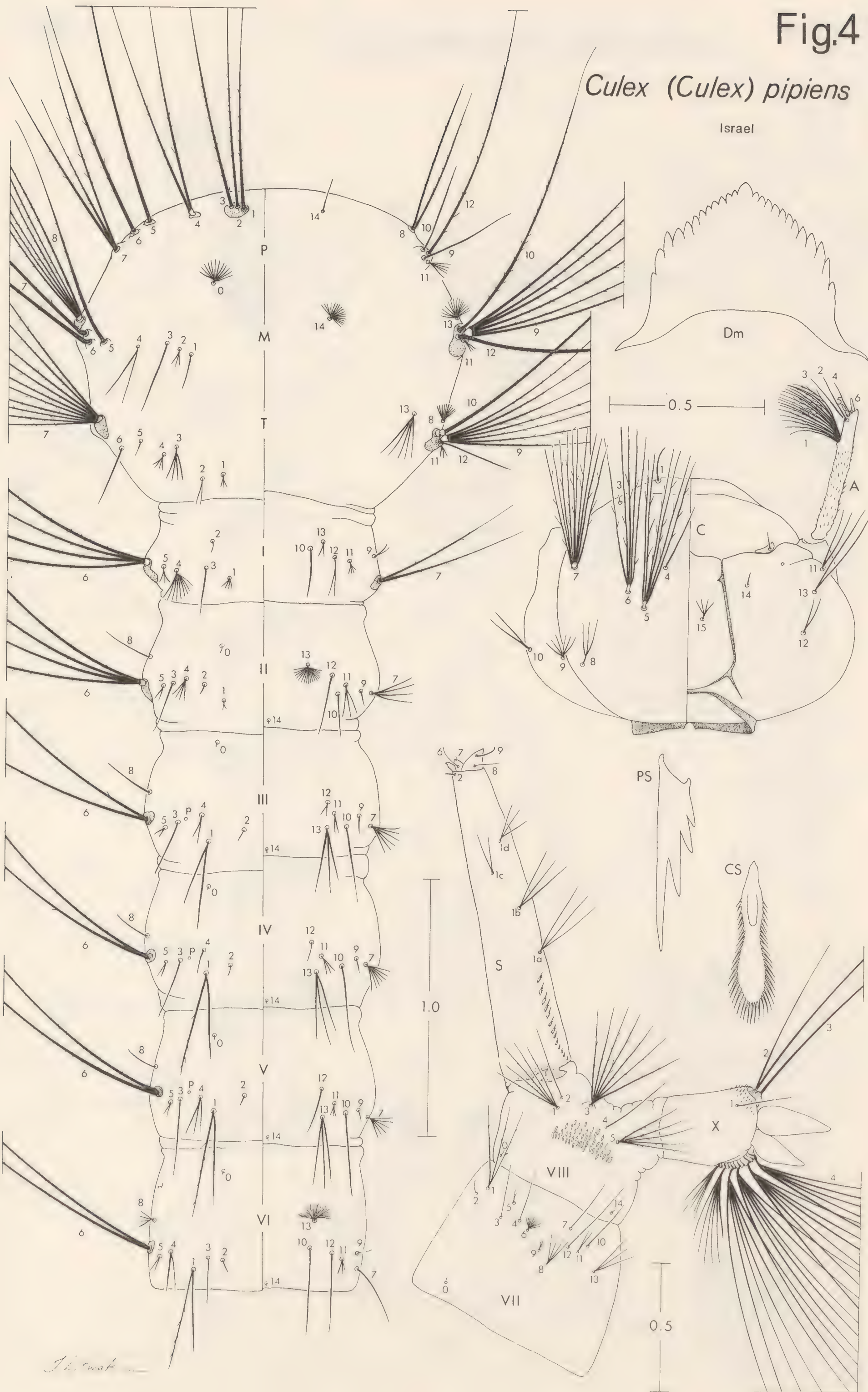
Fig.3



Fig.4

Culex (Culex) pipiens

Israel



Culex (Culex) quinquefasciatus

Fig.5



Fig. 6

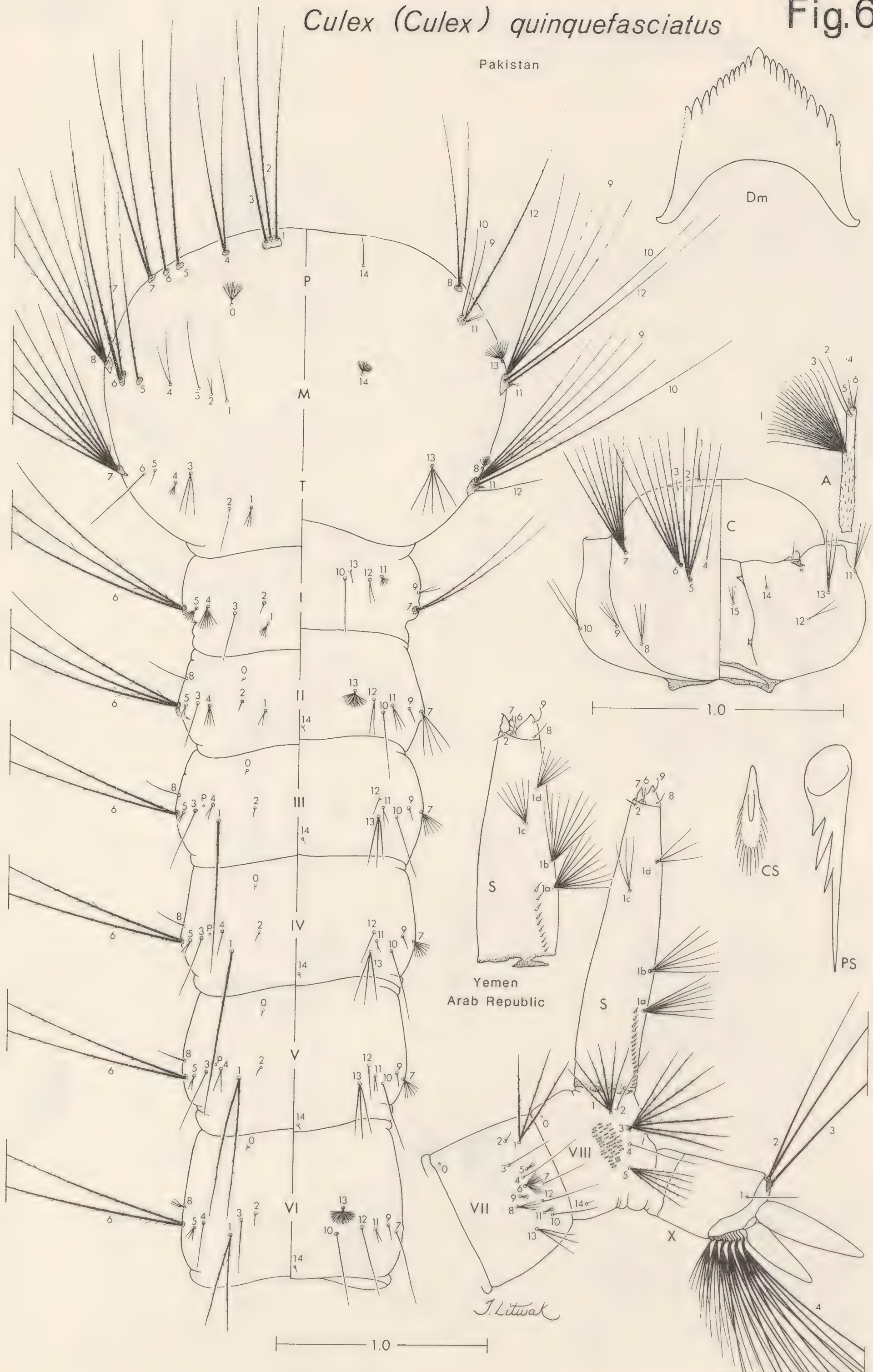


Fig. 7



Culex (Culex) vagans

Fig. 8

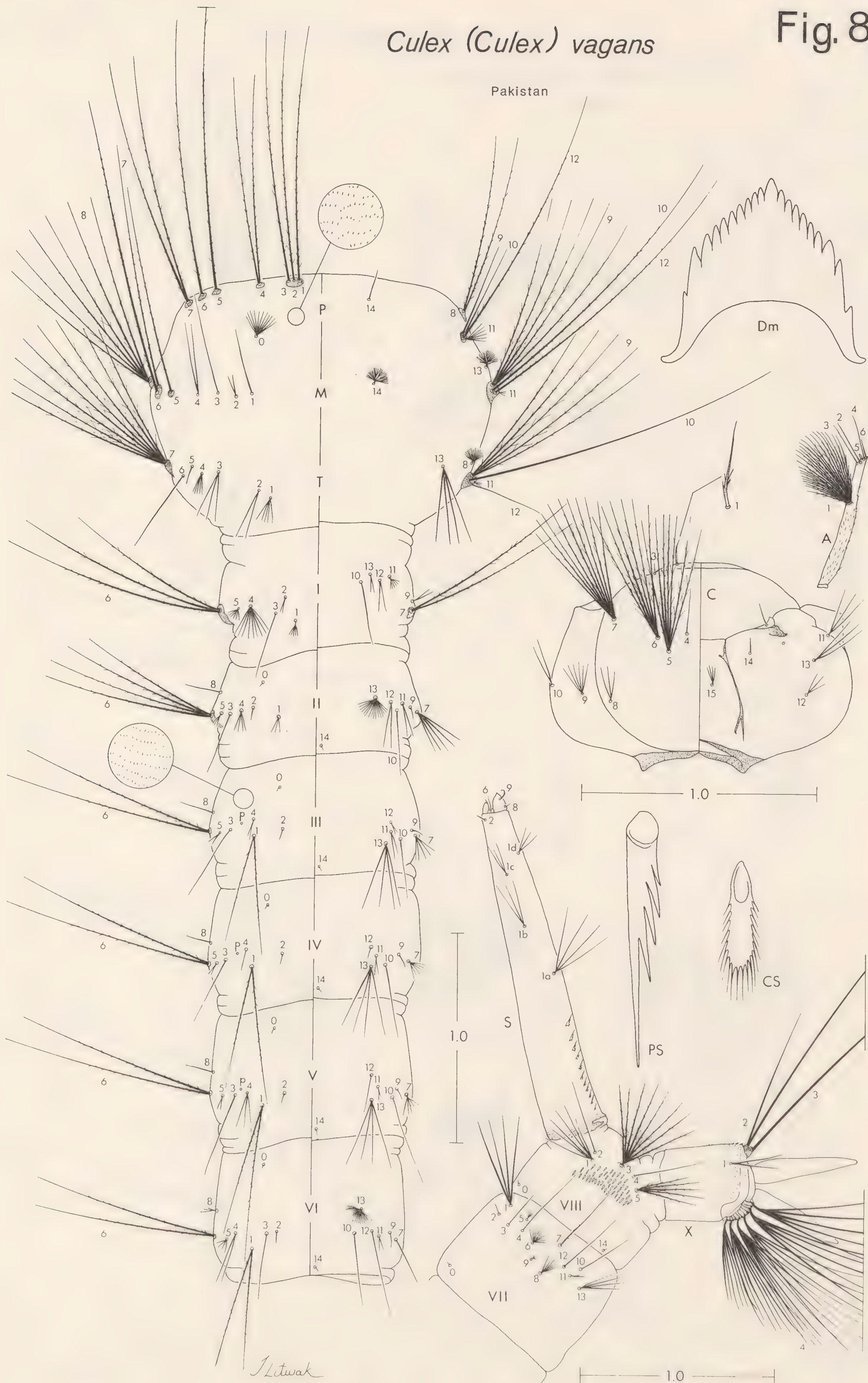


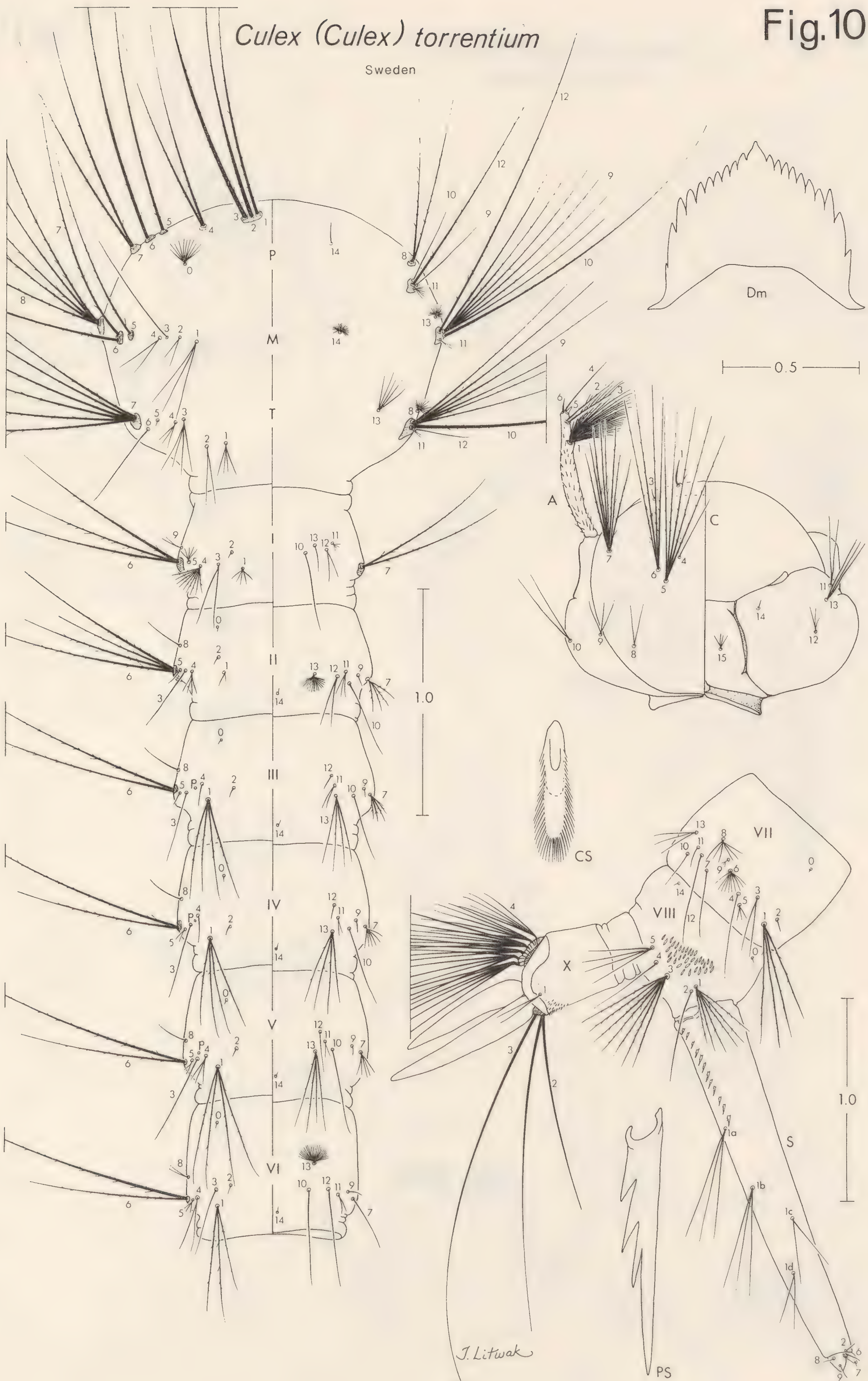
Fig. 9



Culex (Culex) torrentium

Sweden

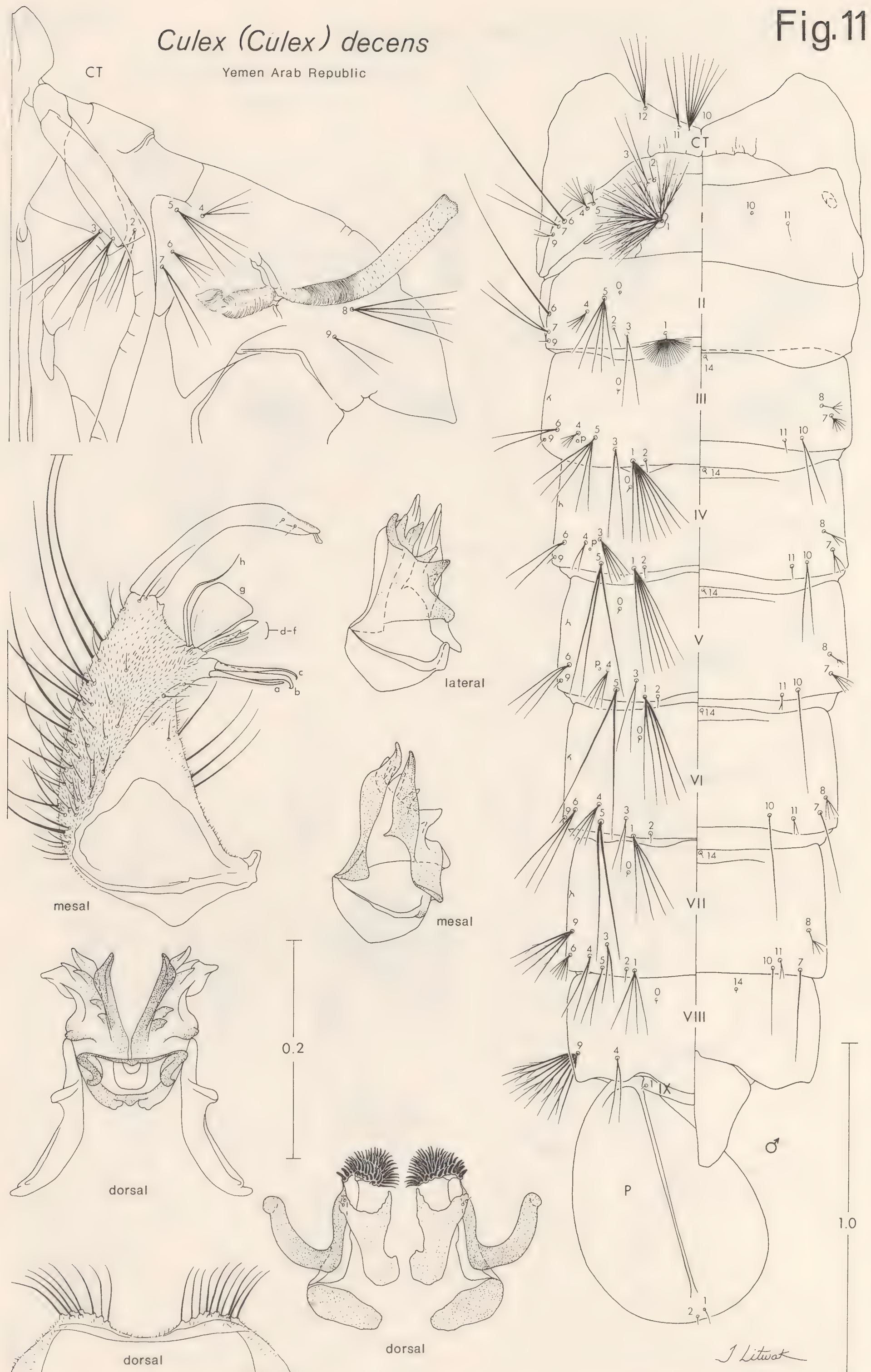
Fig.10



Culex (Culex) decens

Yemen Arab Republic

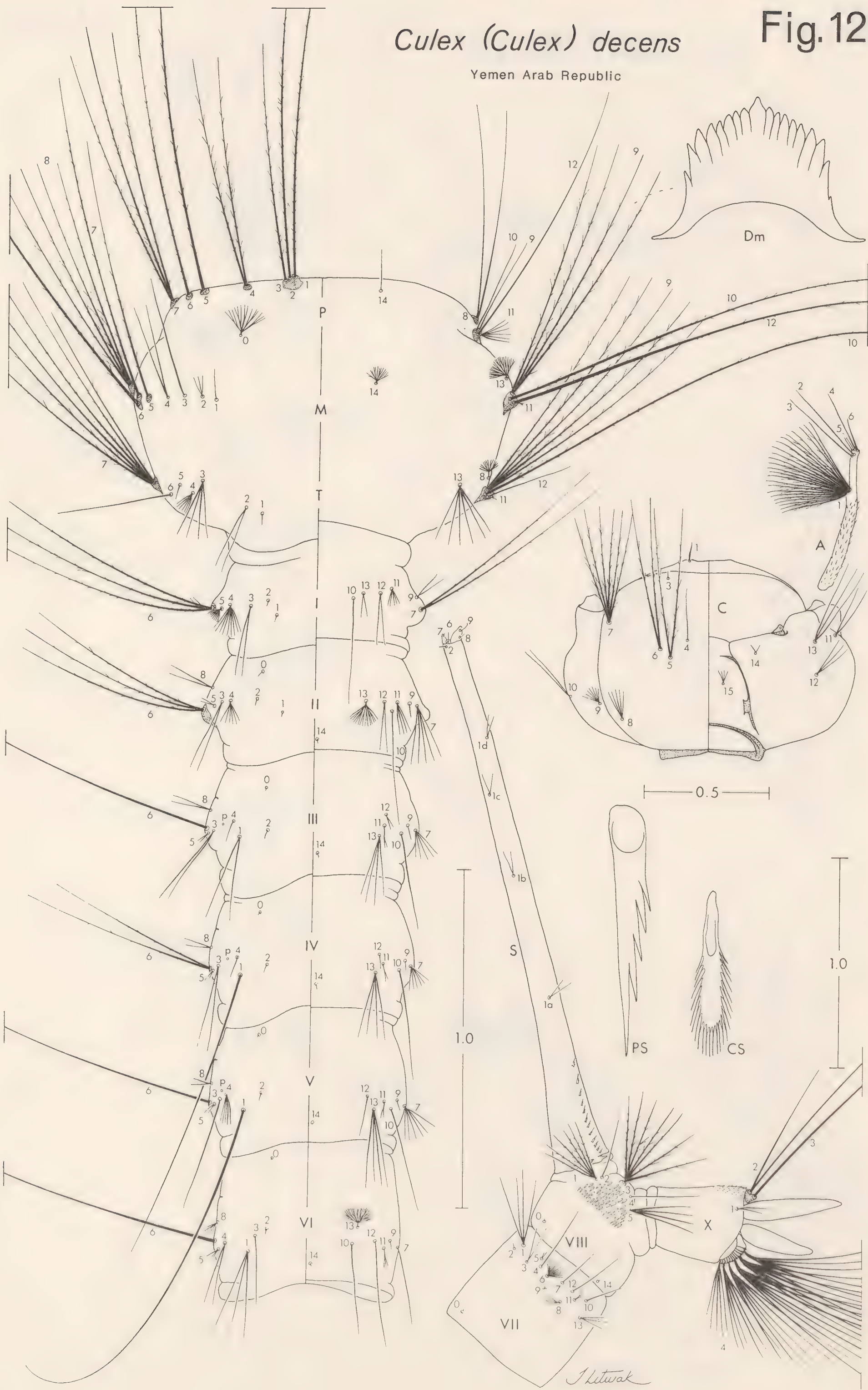
Fig.11

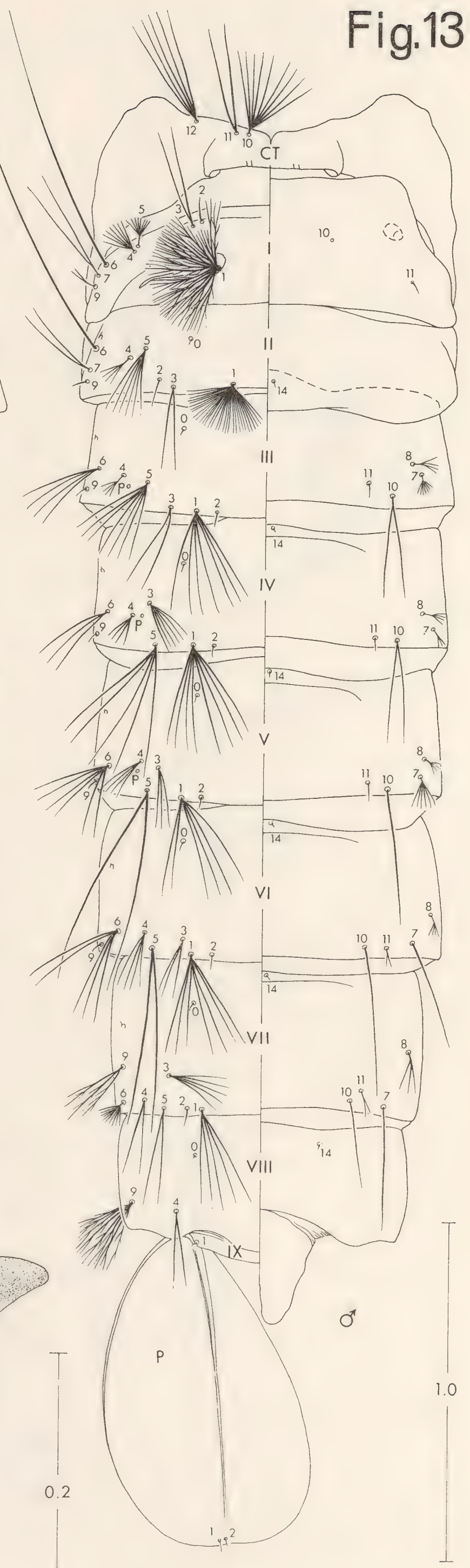
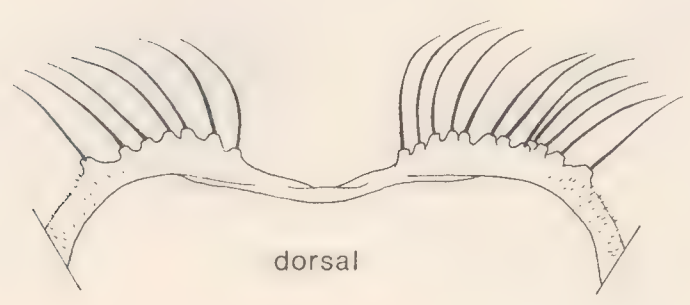
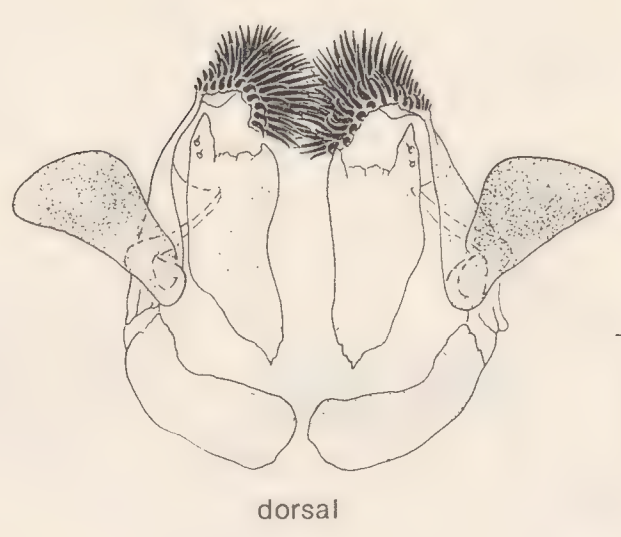
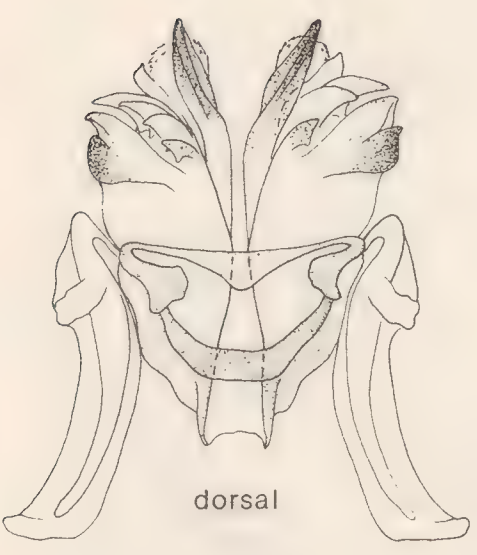
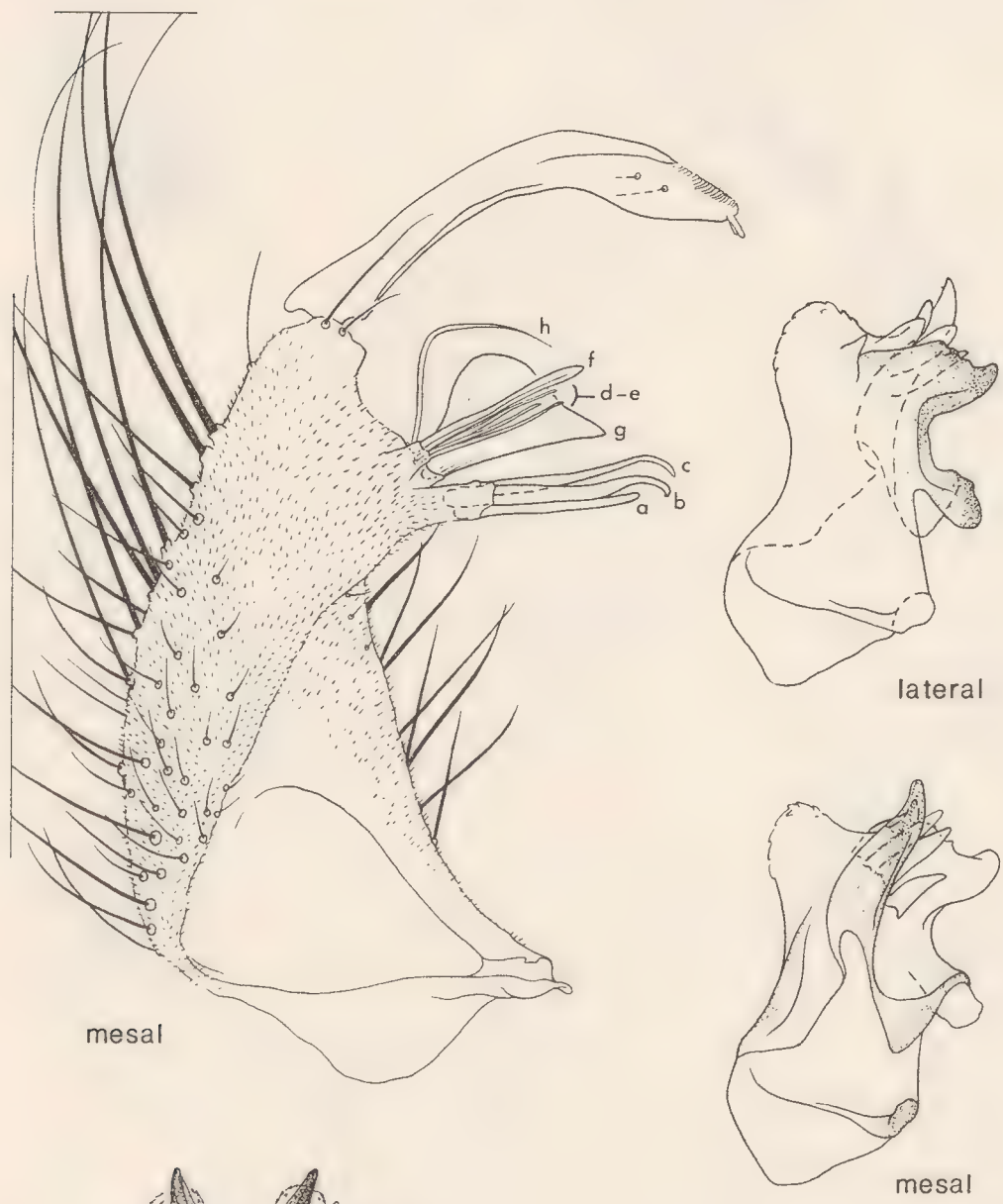
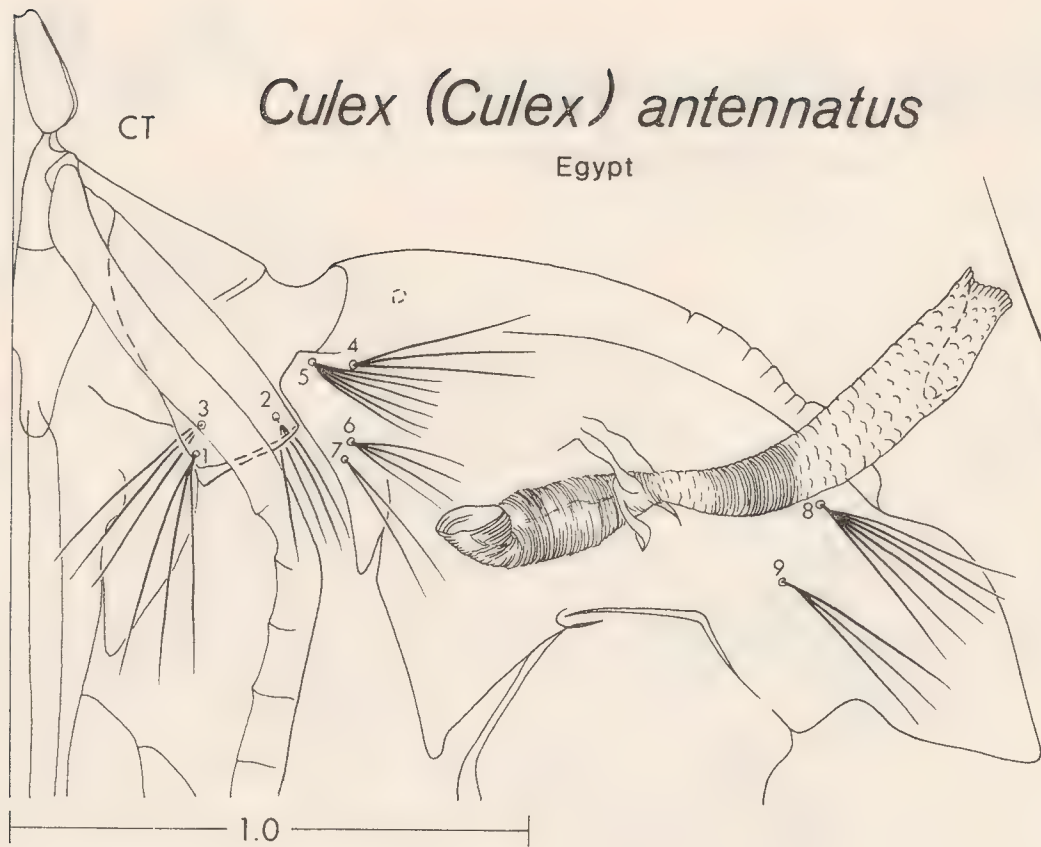


Culex (Culex) decens

Fig.12

Yemen Arab Republic

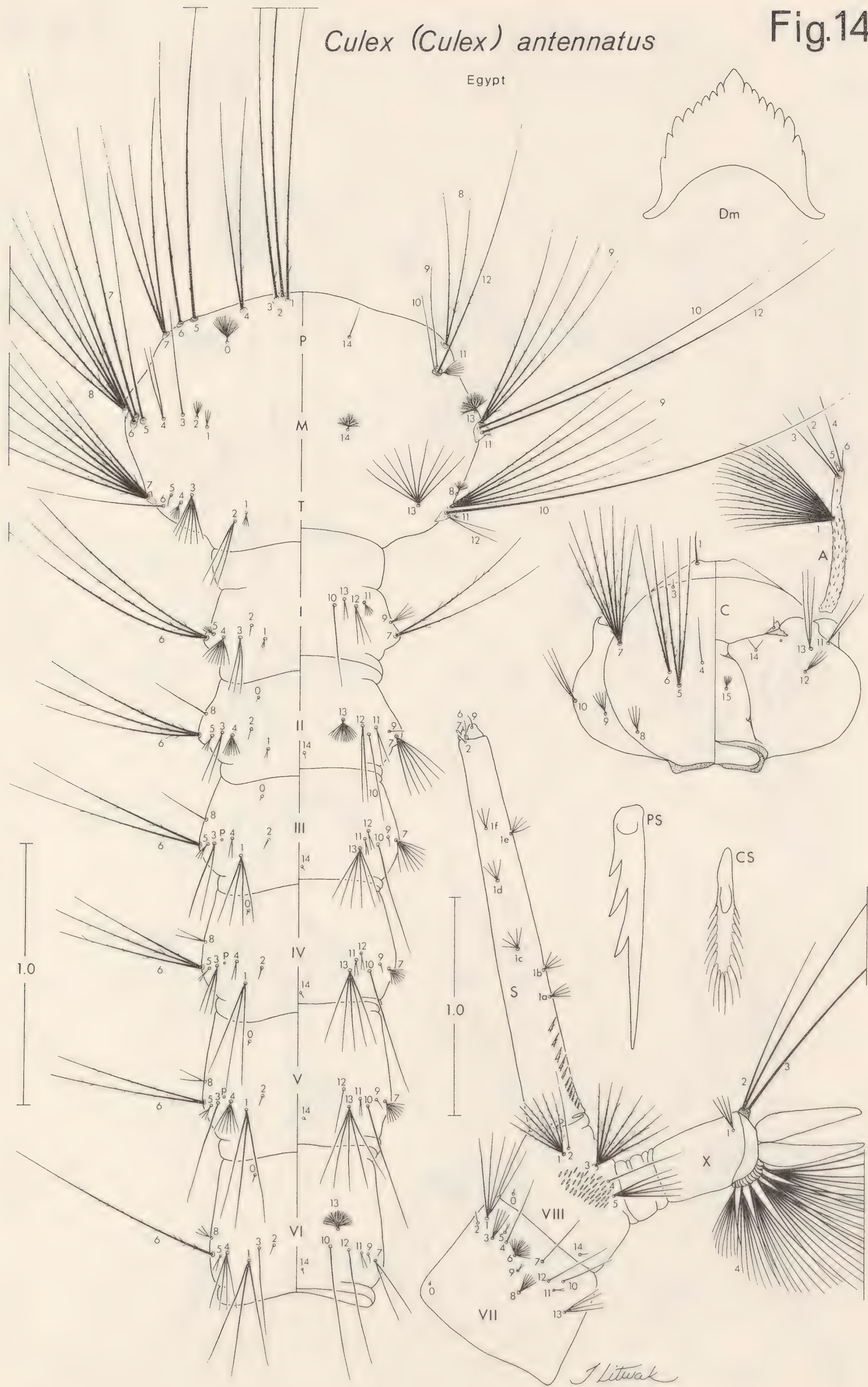




Culex (Culex) antennatus

Fig.14

Egypt

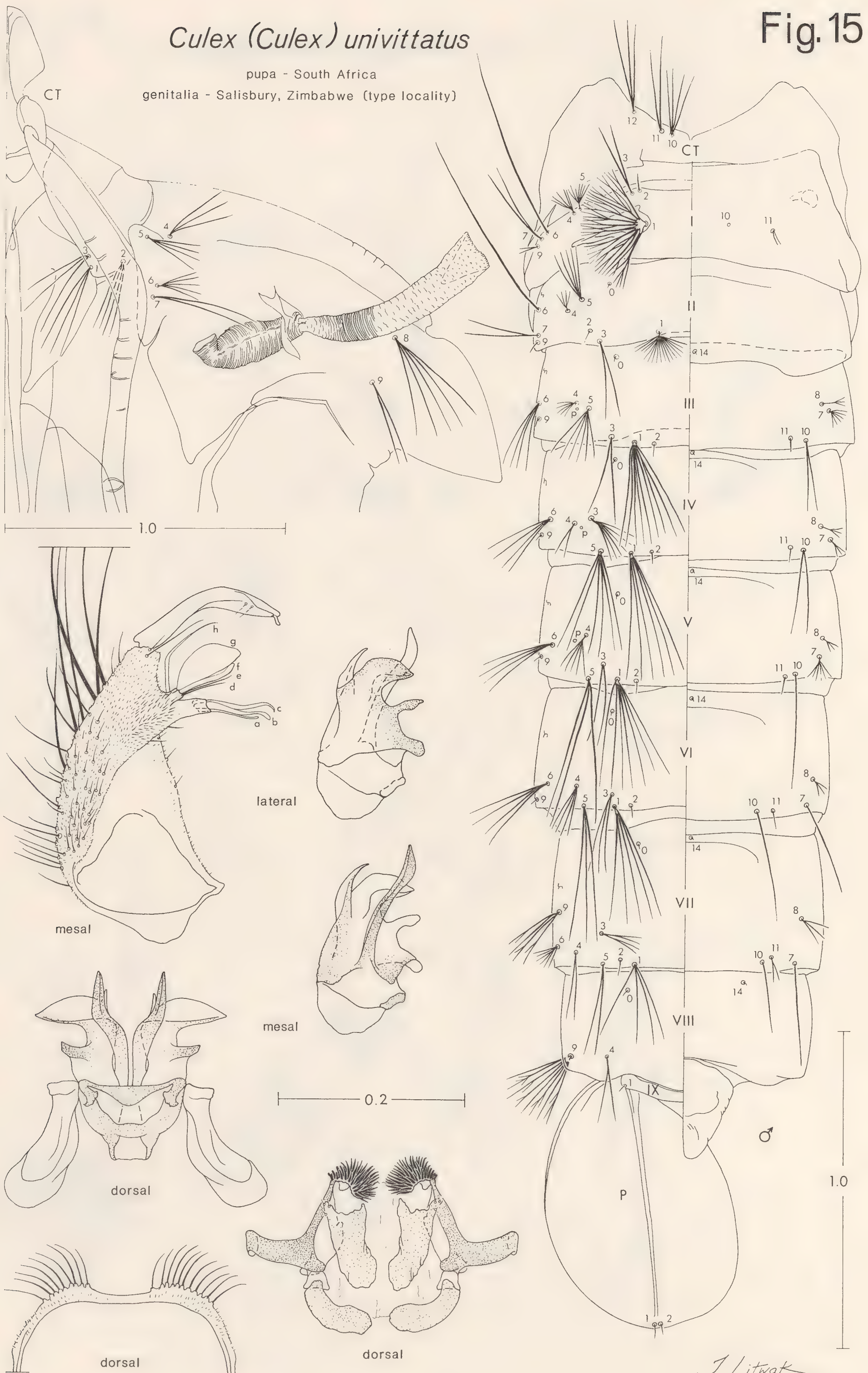


Culex (Culex) univittatus

pupa - South Africa

genitalia - Salisbury, Zimbabwe (type locality)

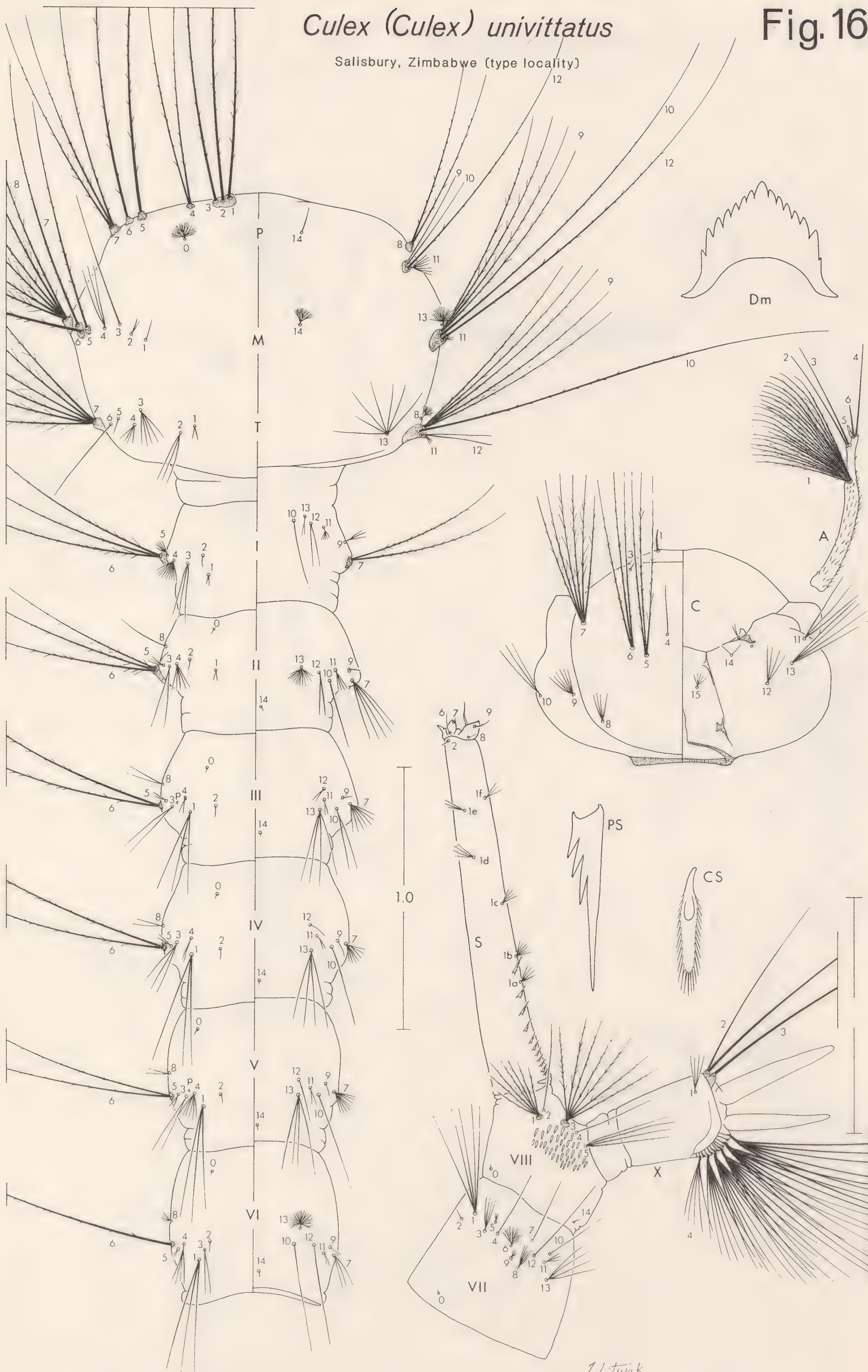
Fig. 15



Culex (Culex) univittatus

Salisbury, Zimbabwe (type locality)

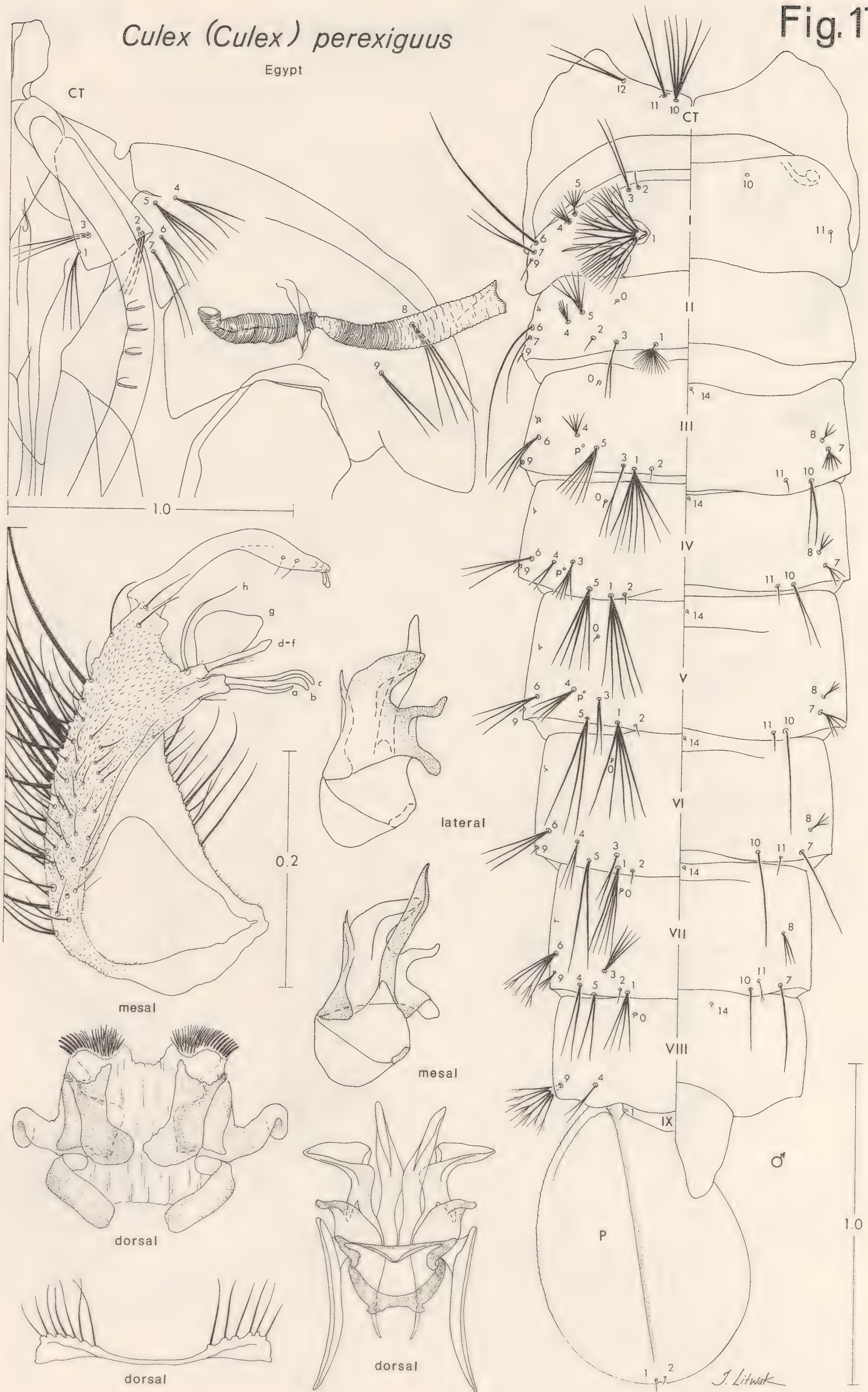
Fig. 16



Culex (Culex) perexiguus

Egypt

Fig. 17



Culex (Culex) perexiguus

Egypt

Fig.18

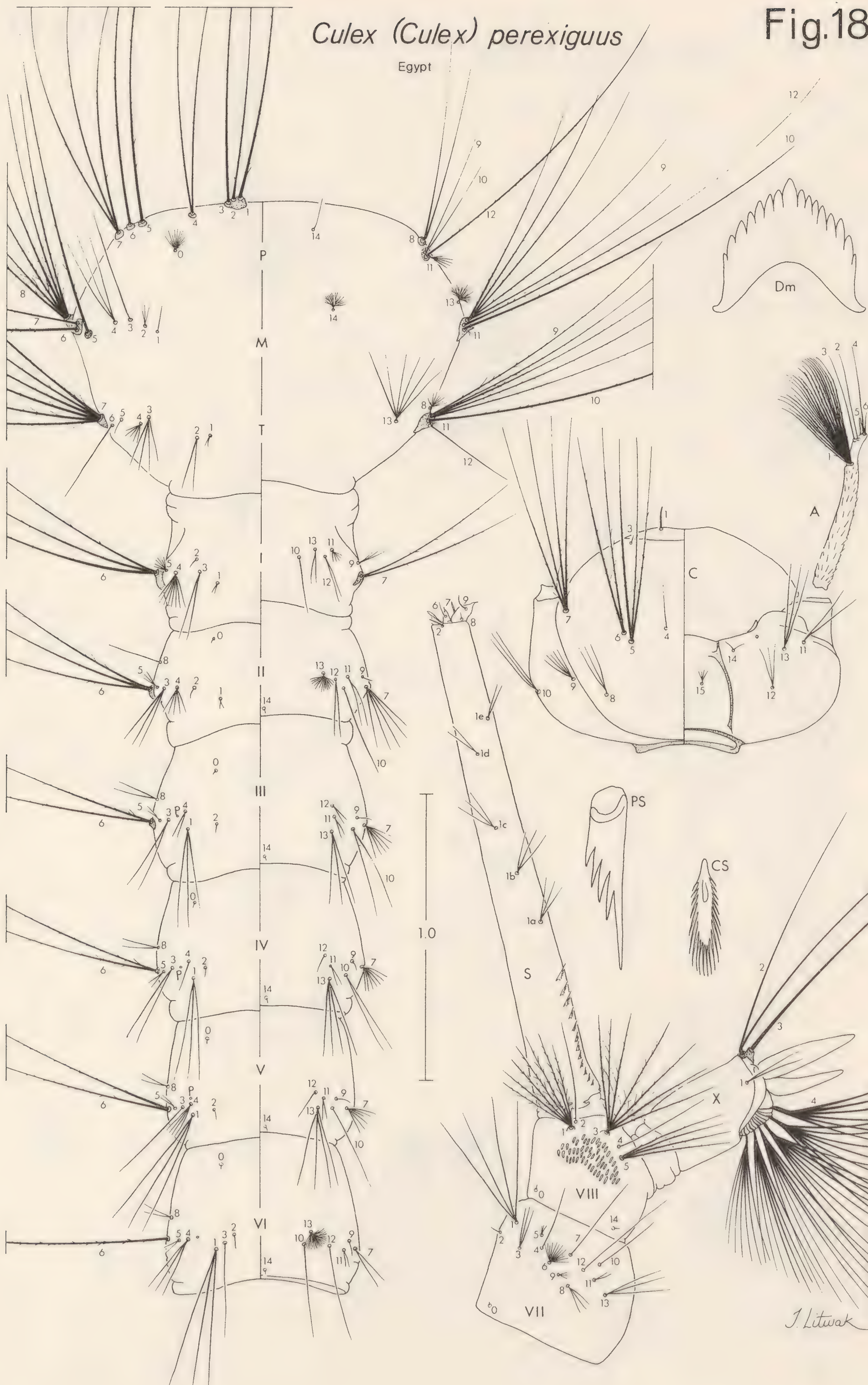
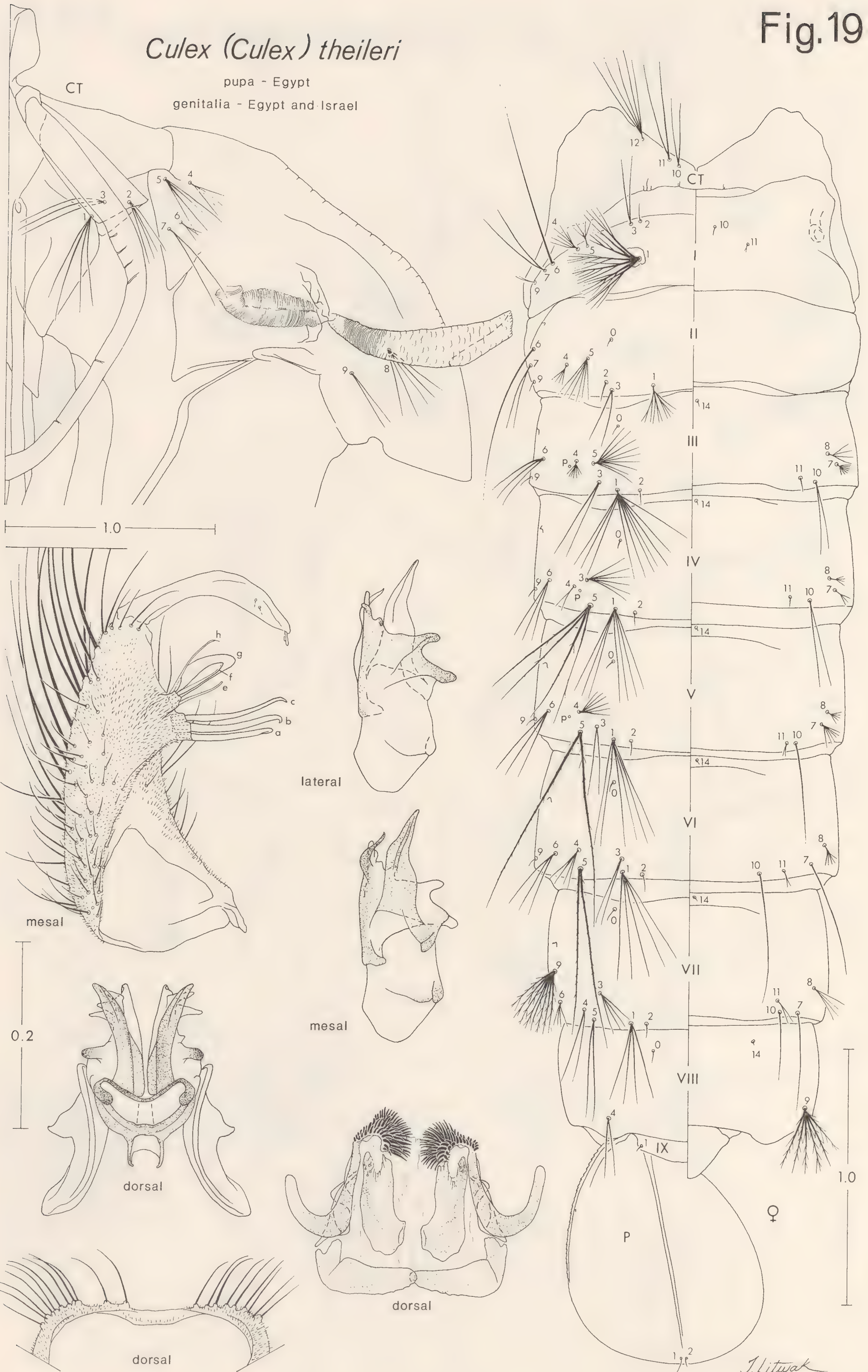


Fig.19

Culex (Culex) theileri

pupa - Egypt

genitalia - Egypt and Israel



Culex (Culex) theileri

Fig. 20

Egypt

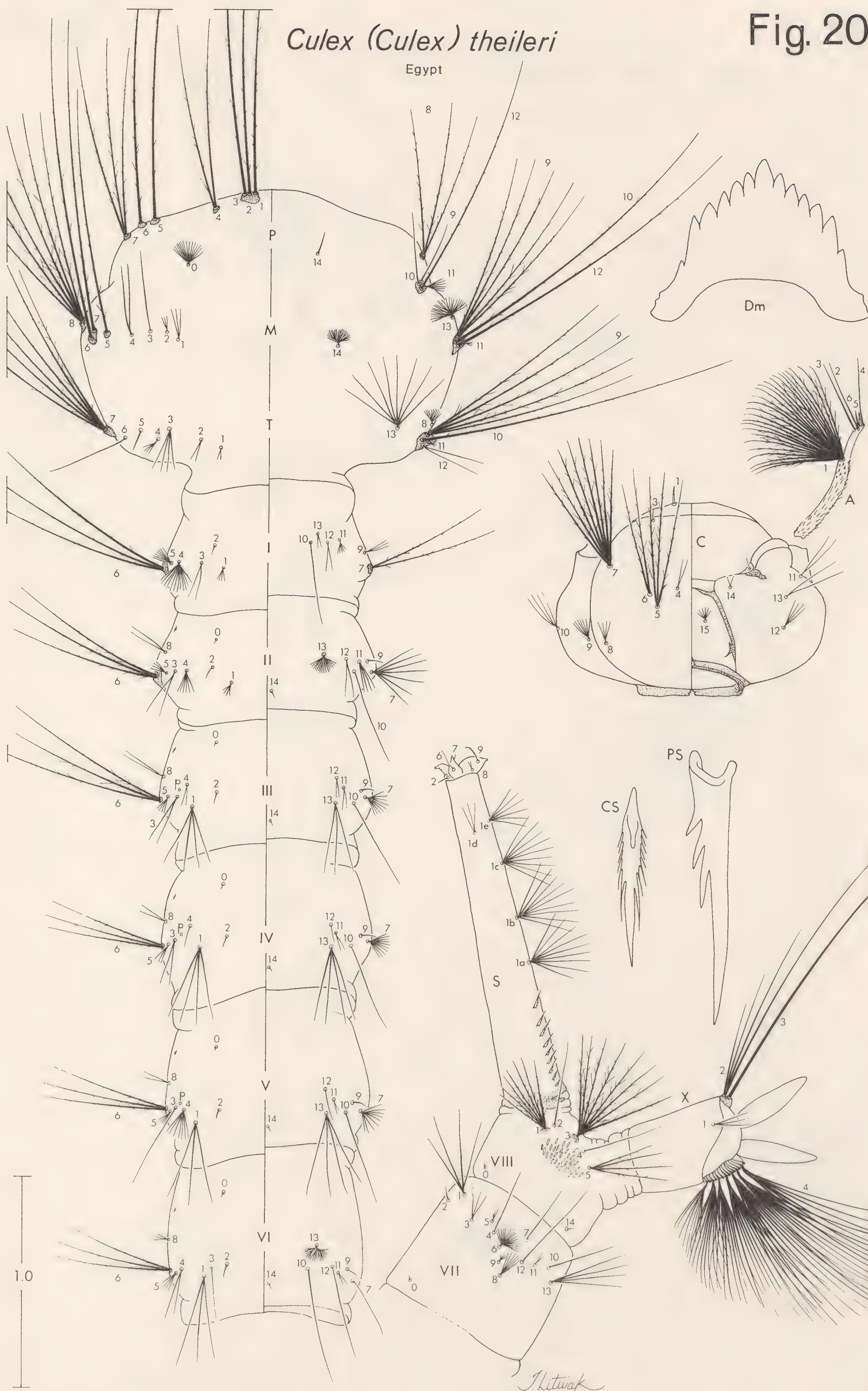


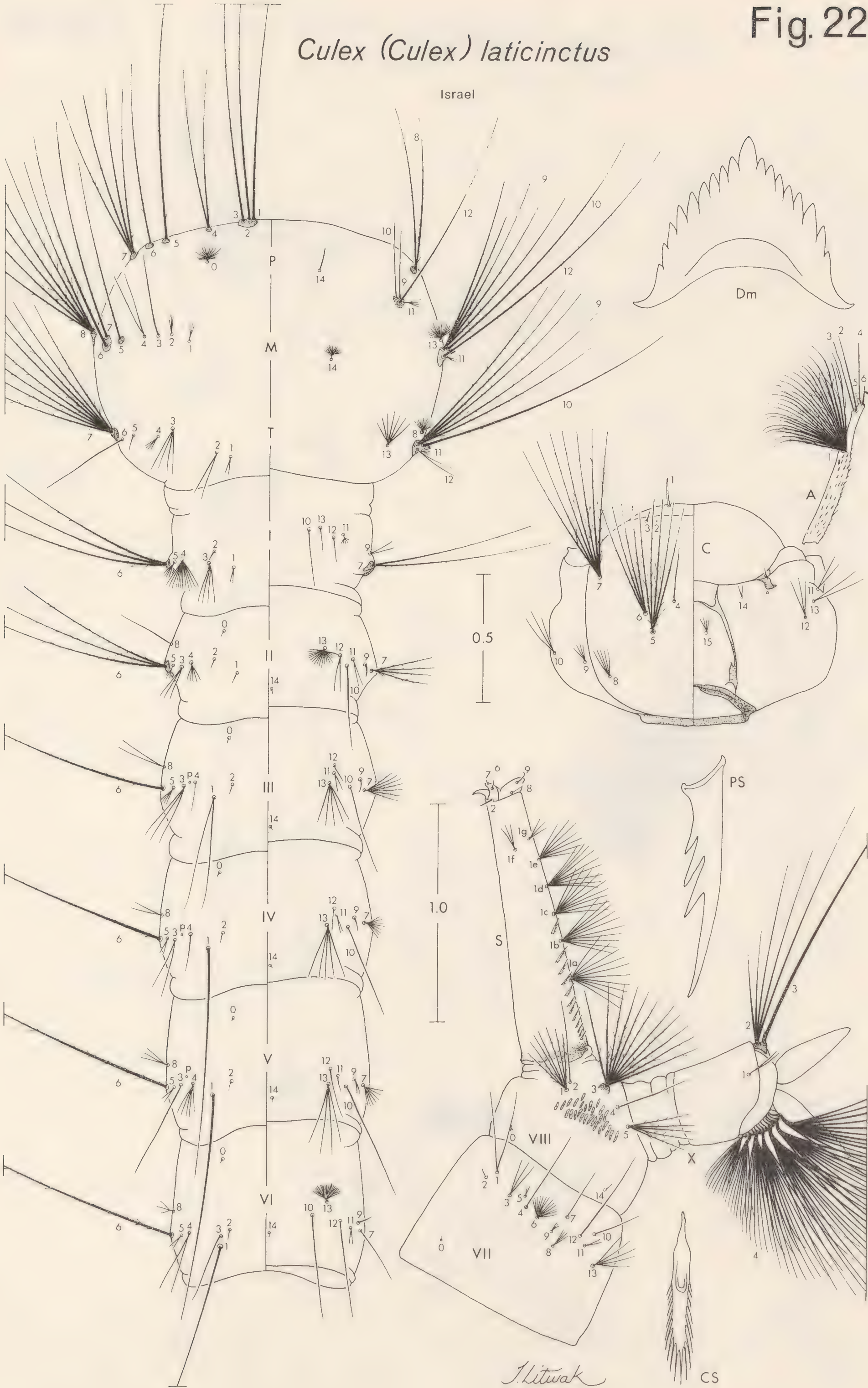
Fig. 21



Fig. 22

Culex (Culex) laticinctus

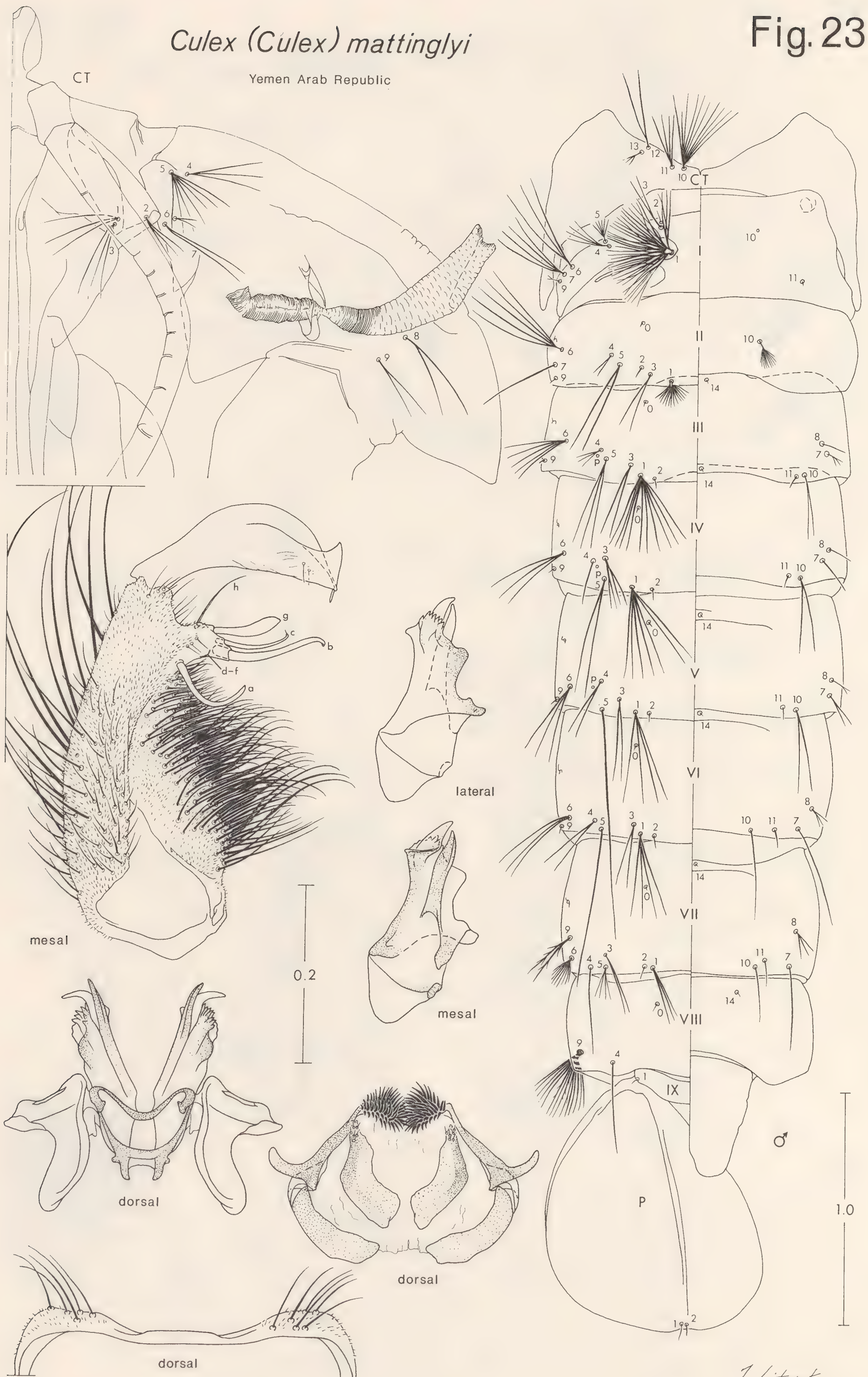
Israel



Culex (Culex) mattinglyi

Fig. 23

Yemen Arab Republic



Culex (Culex) mattinglyi

Fig. 24

Yemen Arab Republic

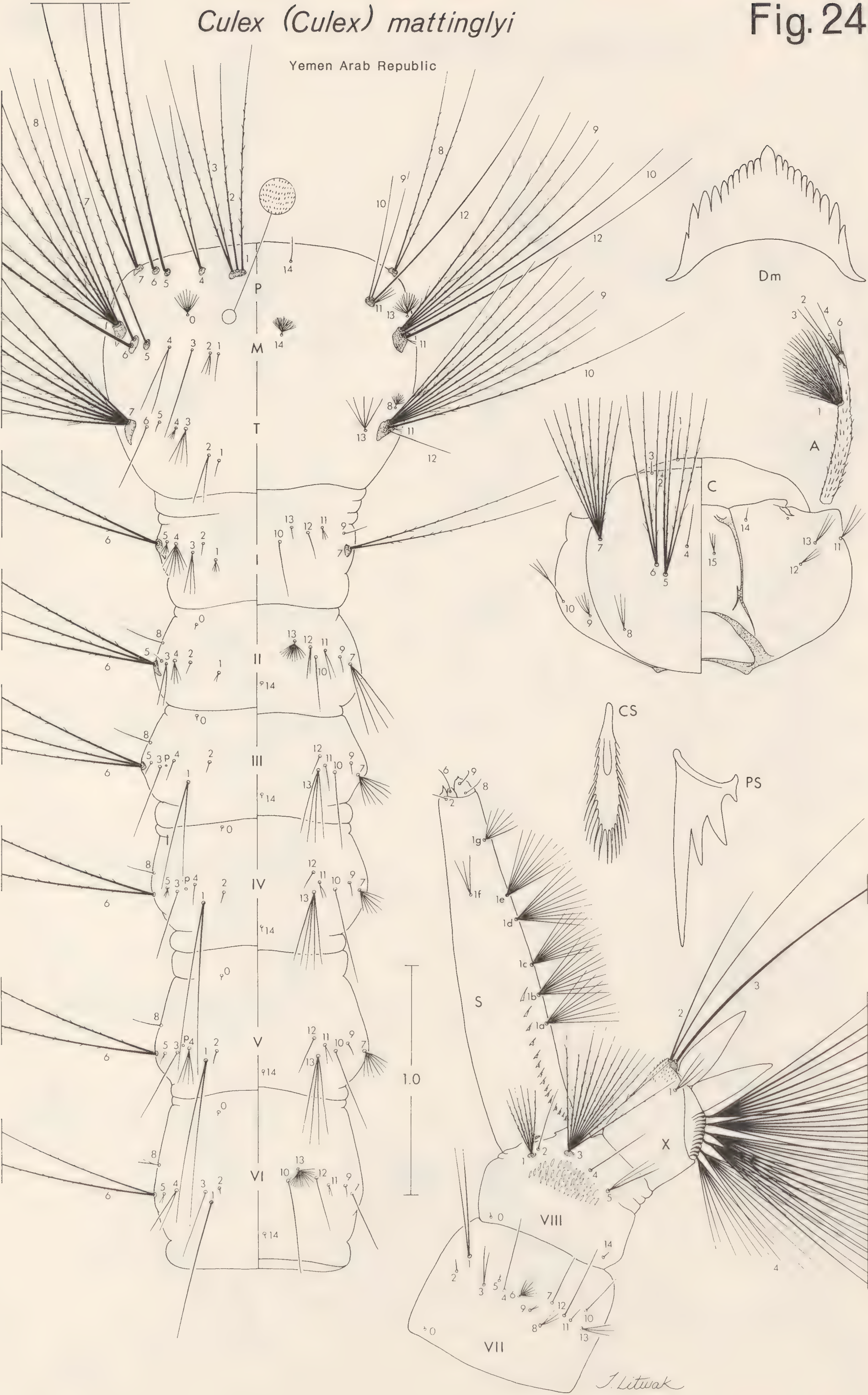
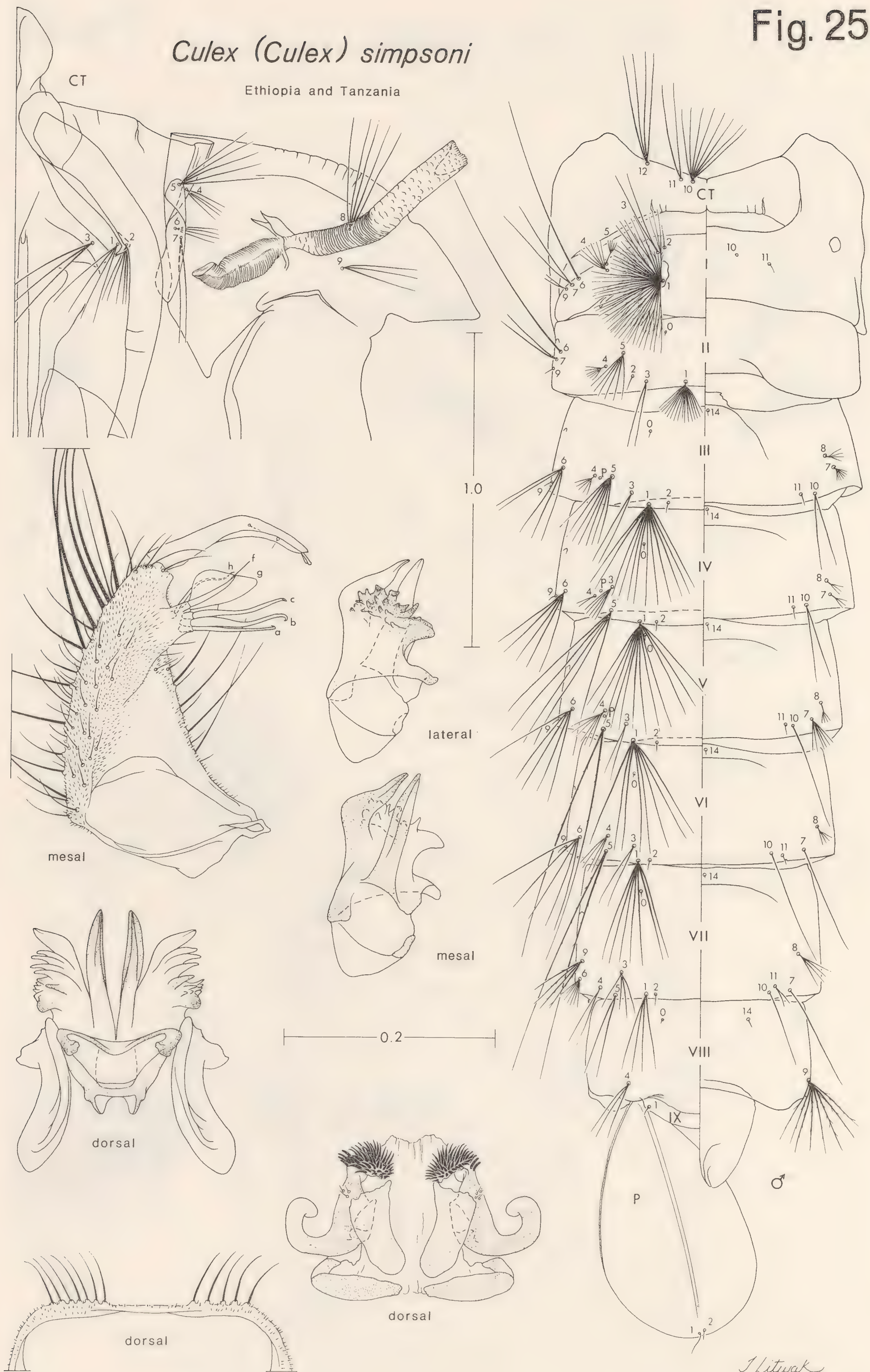


Fig. 25

Culex (Culex) simpsoni

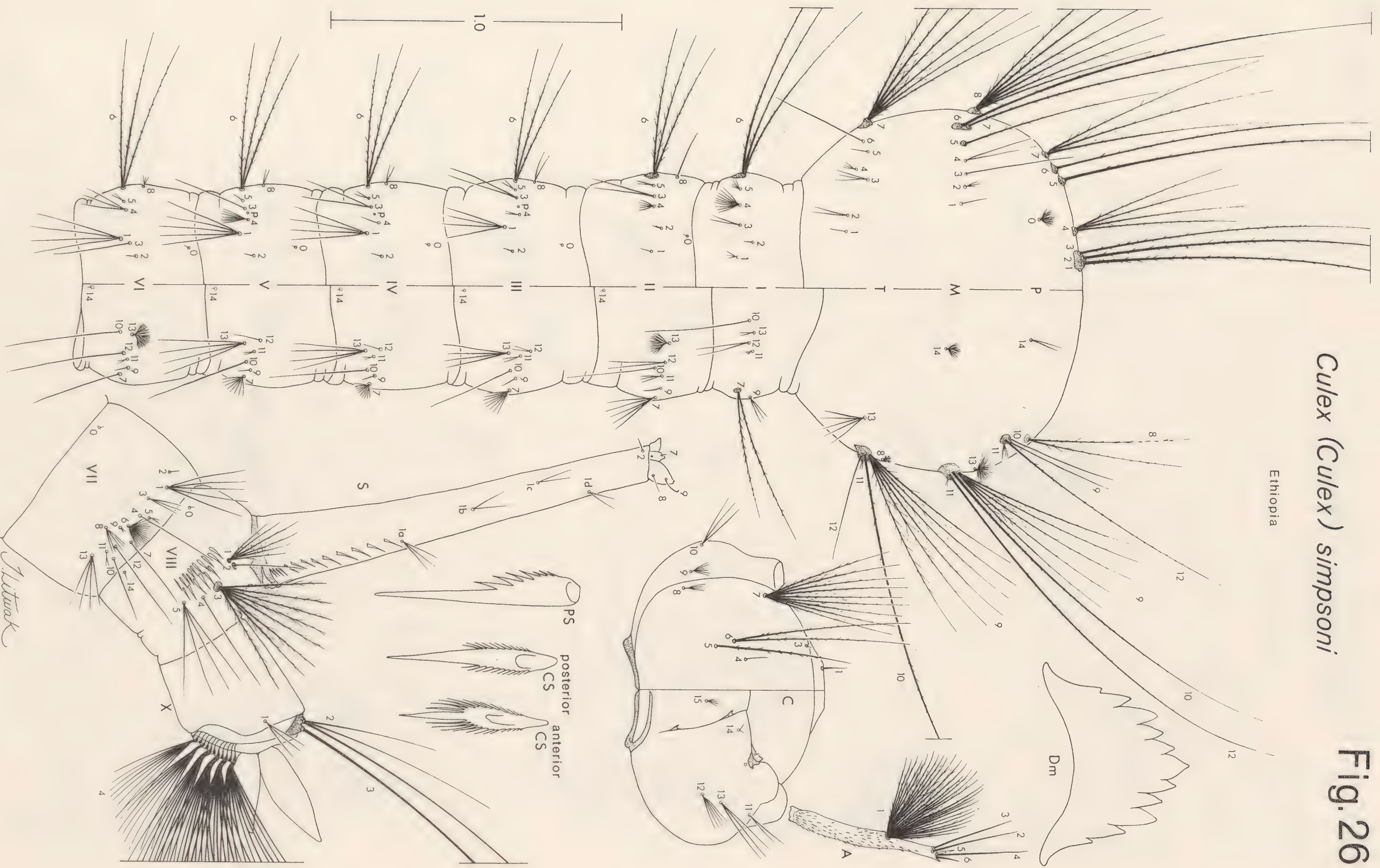
Ethiopia and Tanzania



Culex (Culex) simpsoni

Fig. 26

Ethiopia



Culex (Culex) sinaiticus

Fig.27

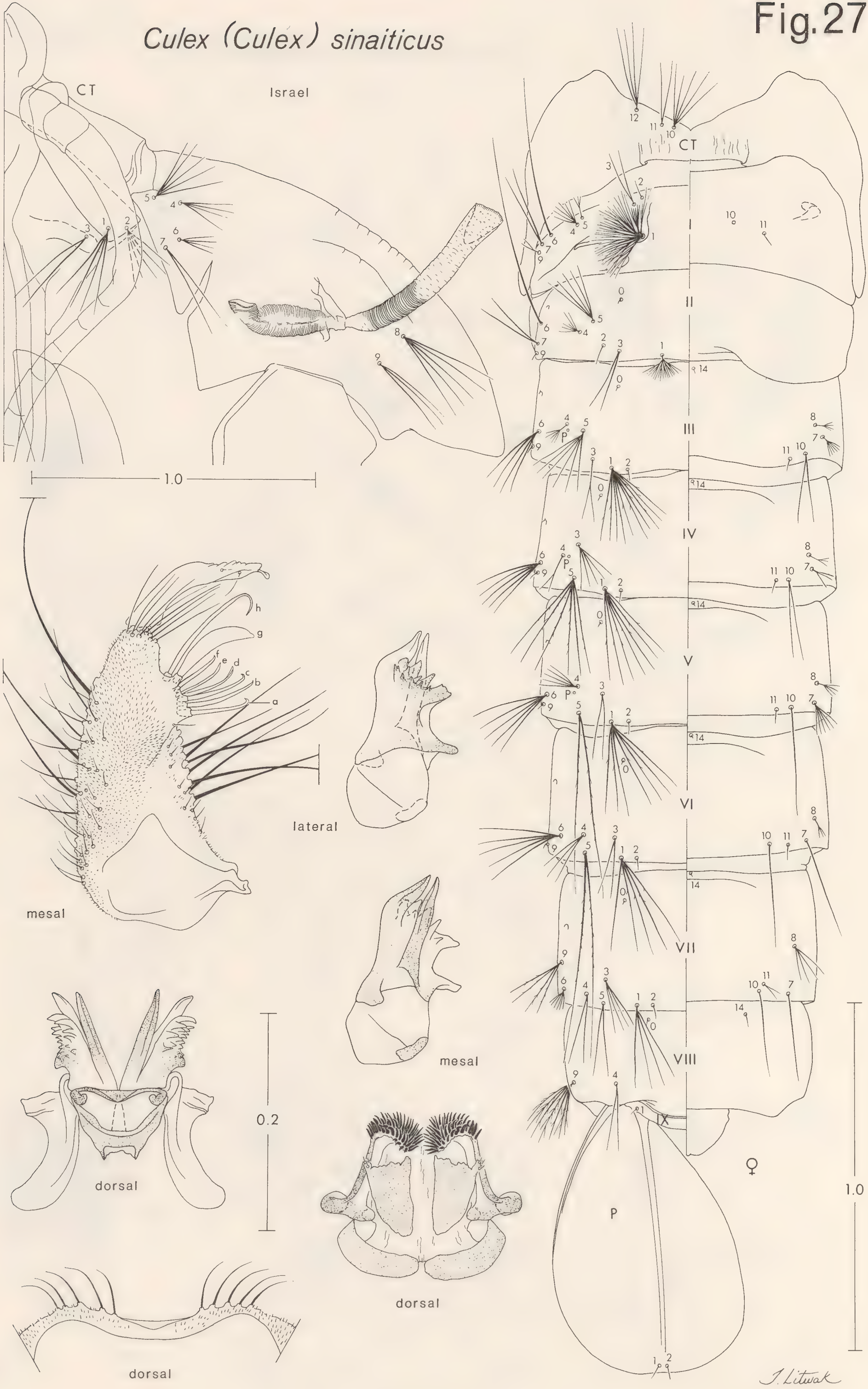
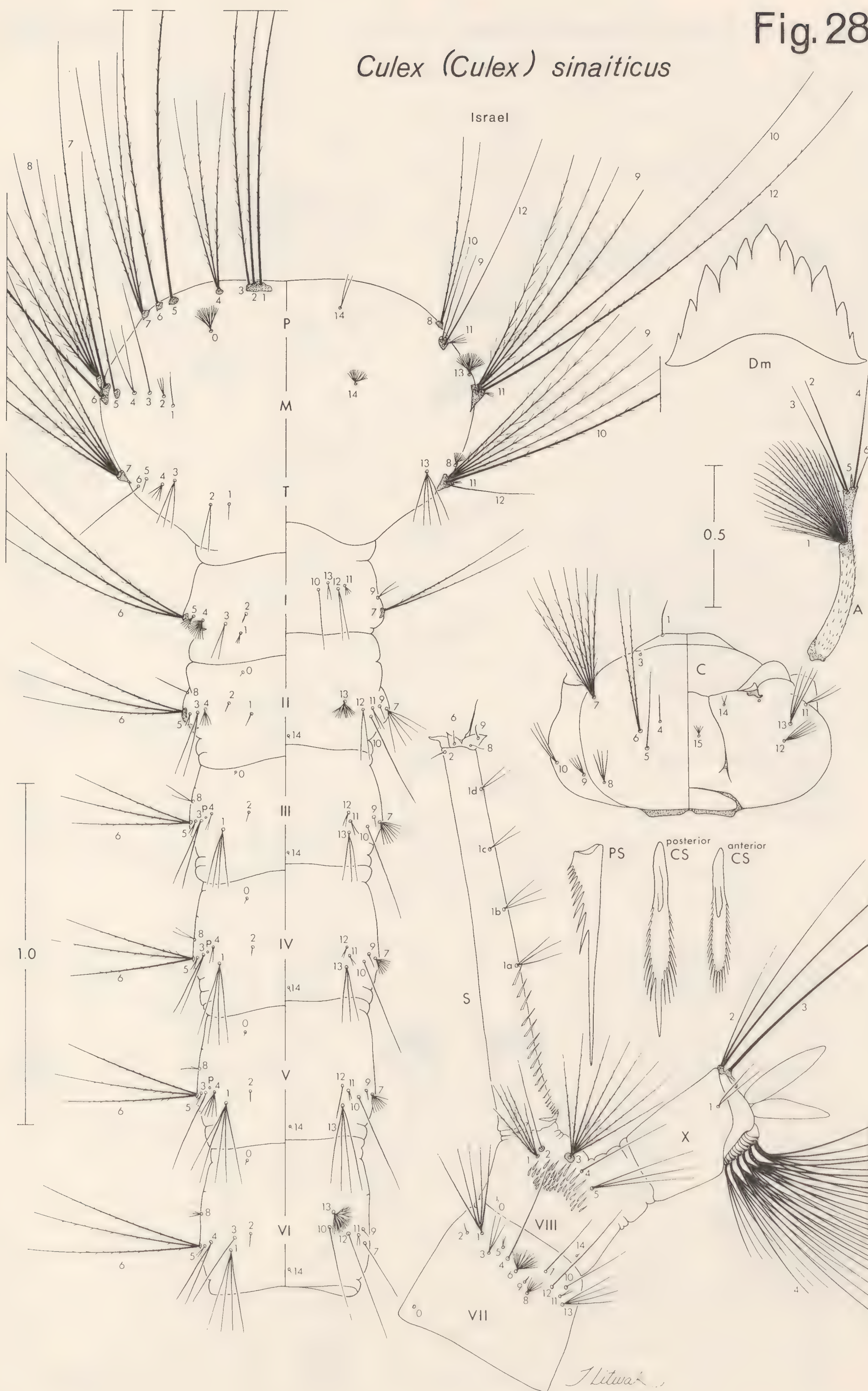


Fig. 28

Culex (Culex) sinaiticus

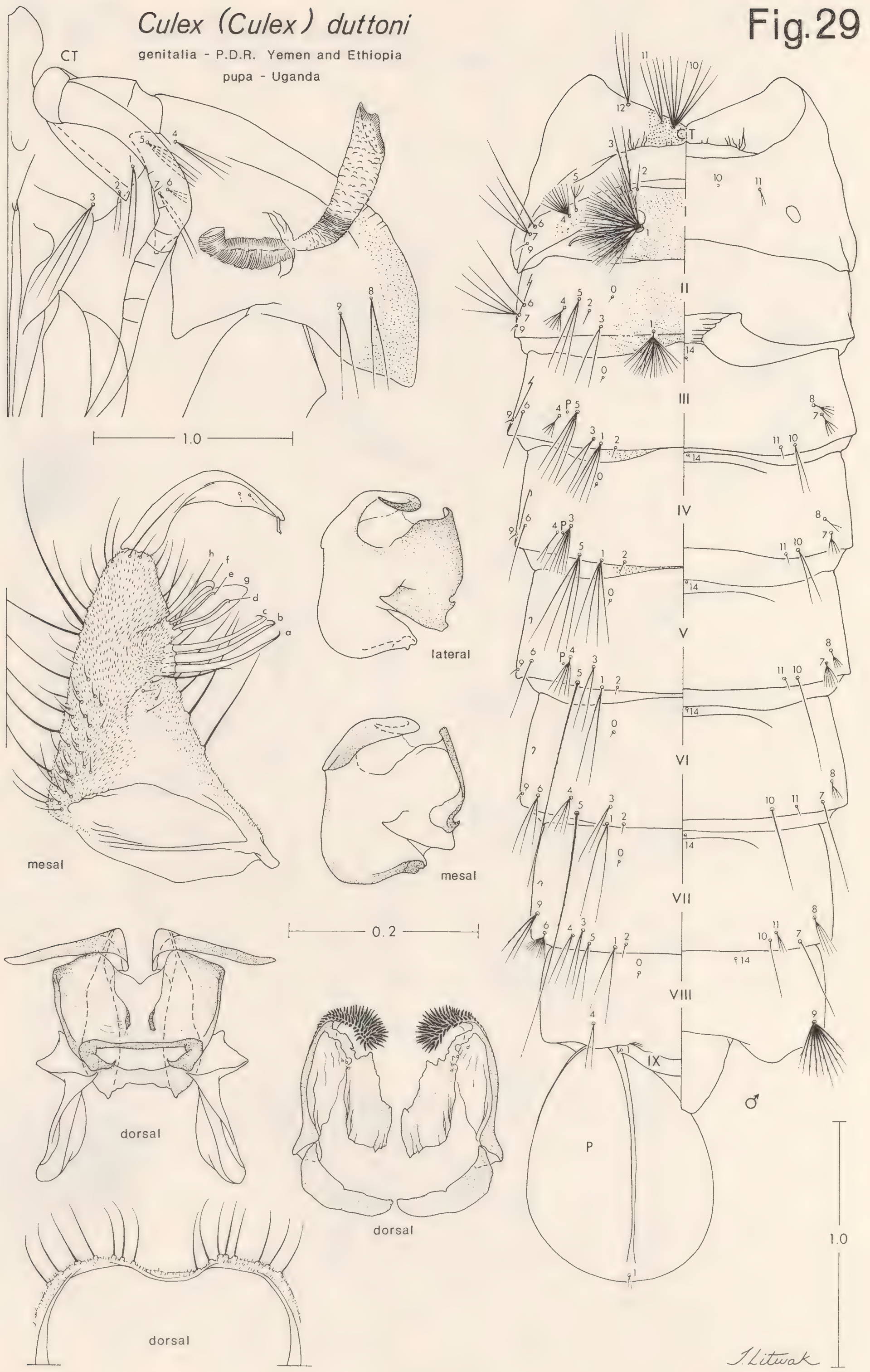
Israel



Culex (Culex) duttoni

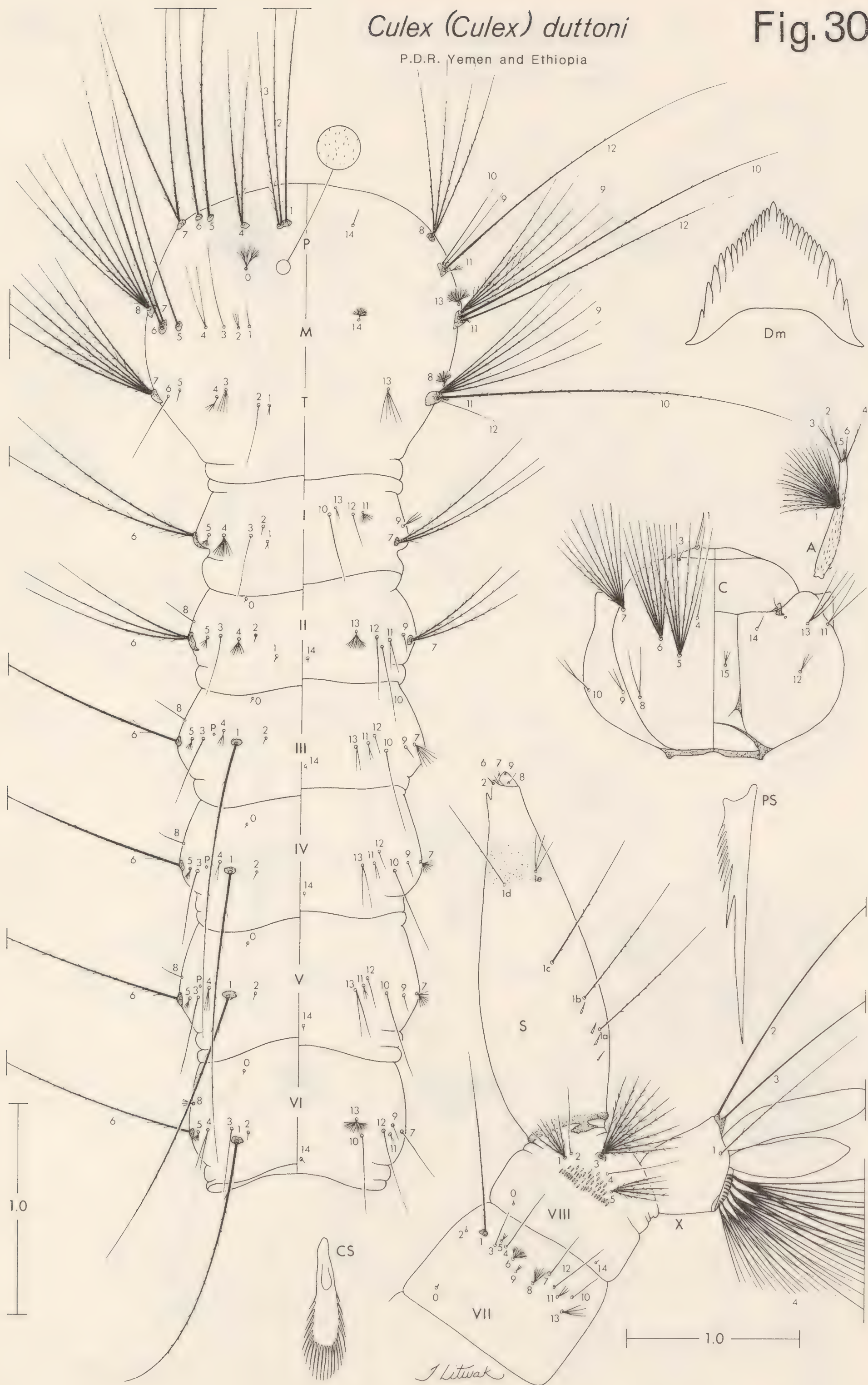
genitalia - P.D.R. Yemen and Ethiopia
pupa - Uganda

Fig.29



Culex (Culex) duttoni
P.D.R. Yemen and Ethiopia

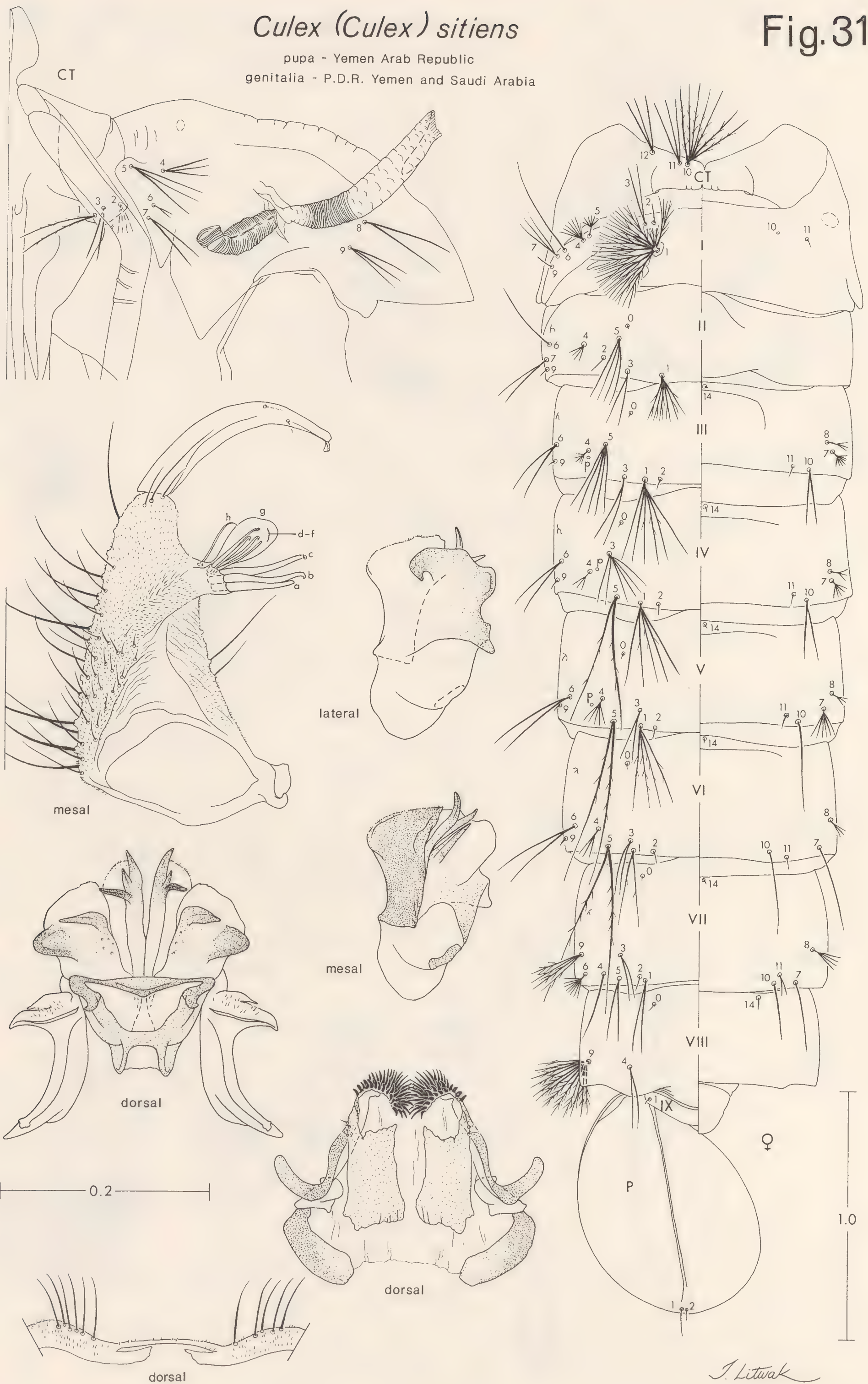
Fig. 30



Culex (Culex) sitiens

pupa - Yemen Arab Republic
genitalia - P.D.R. Yemen and Saudi Arabia

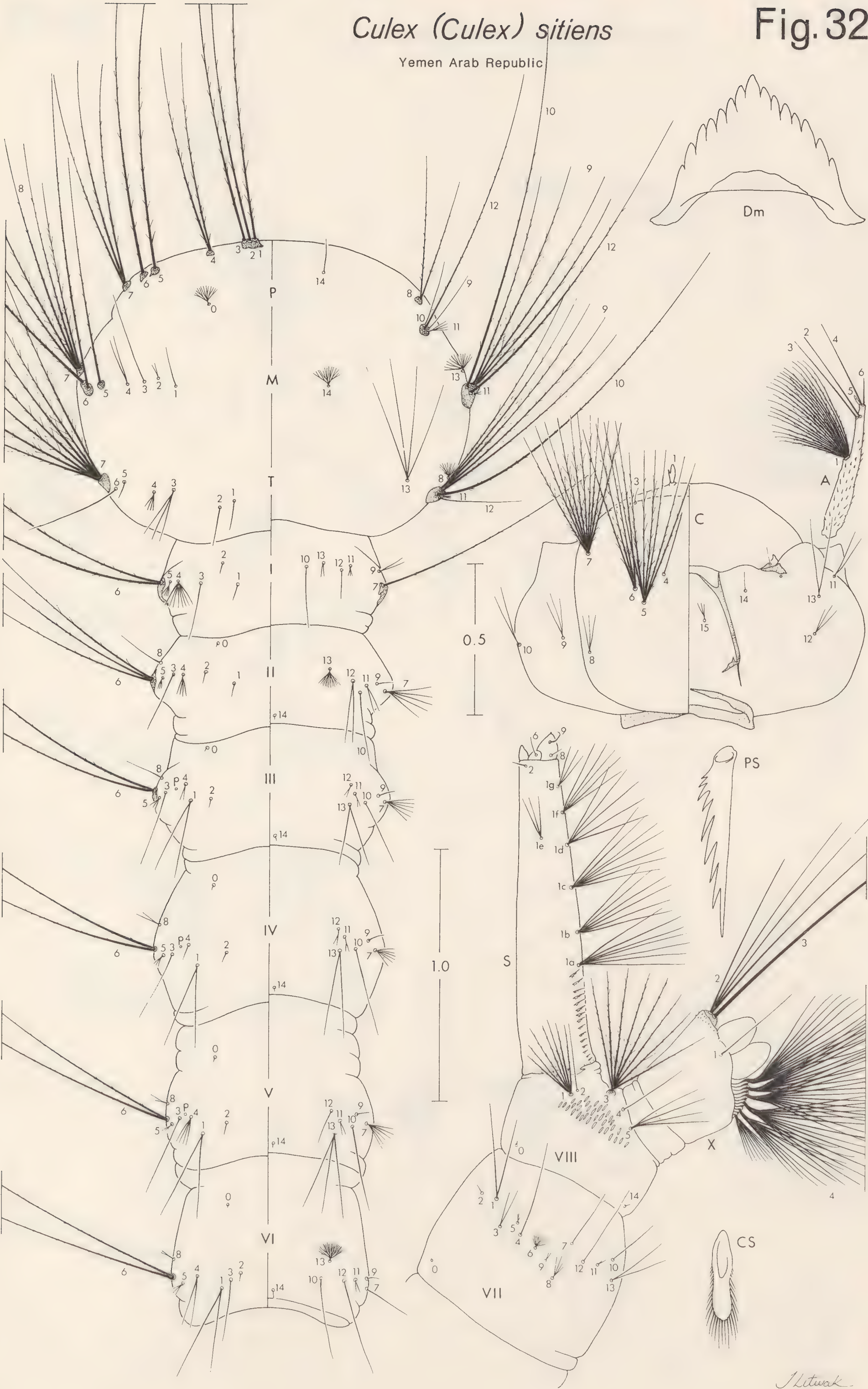
Fig.31



Culex (Culex) sitiens

Yemen Arab Republic

Fig.32



Culex (Culex) poicilipes

Fig. 33

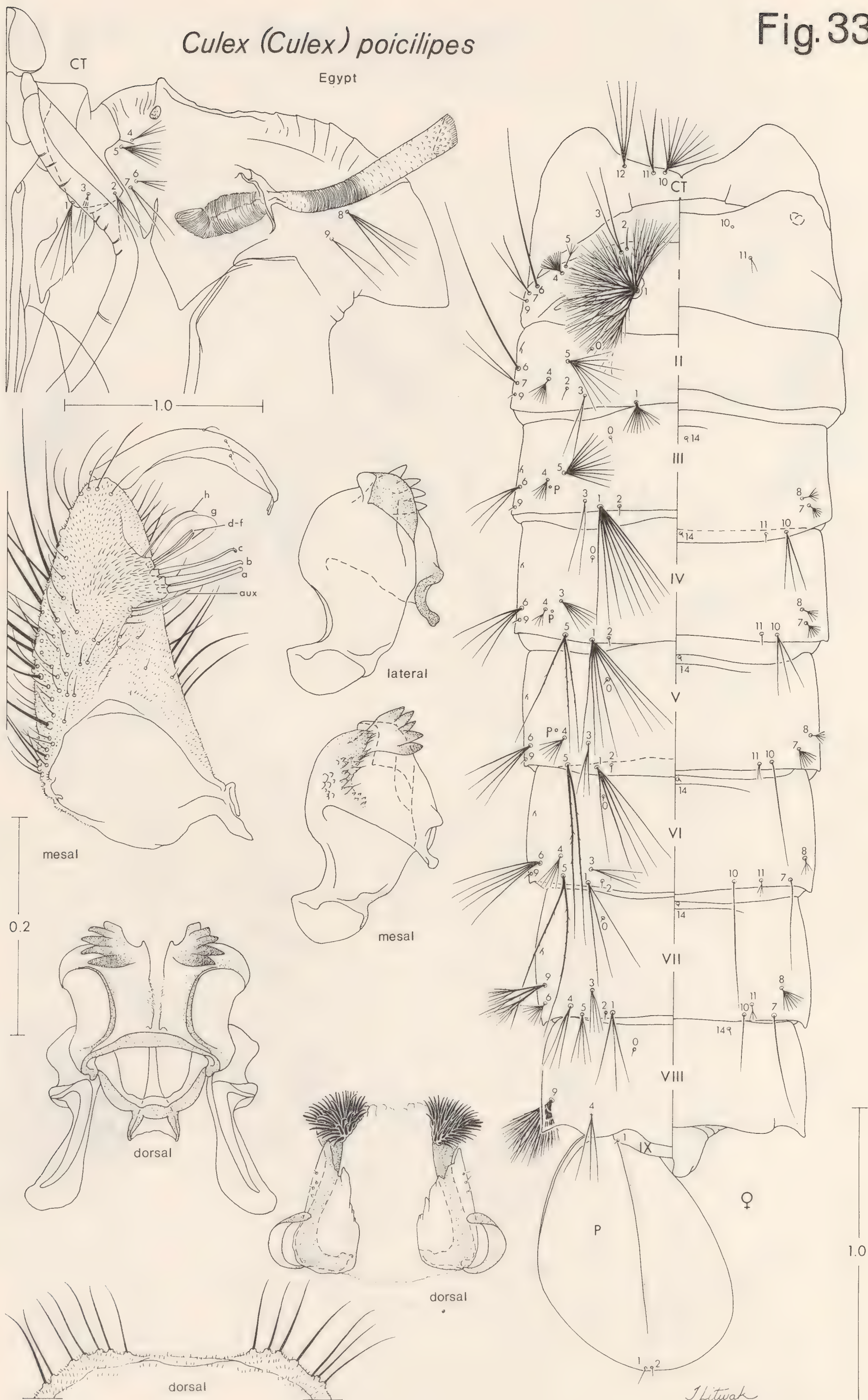
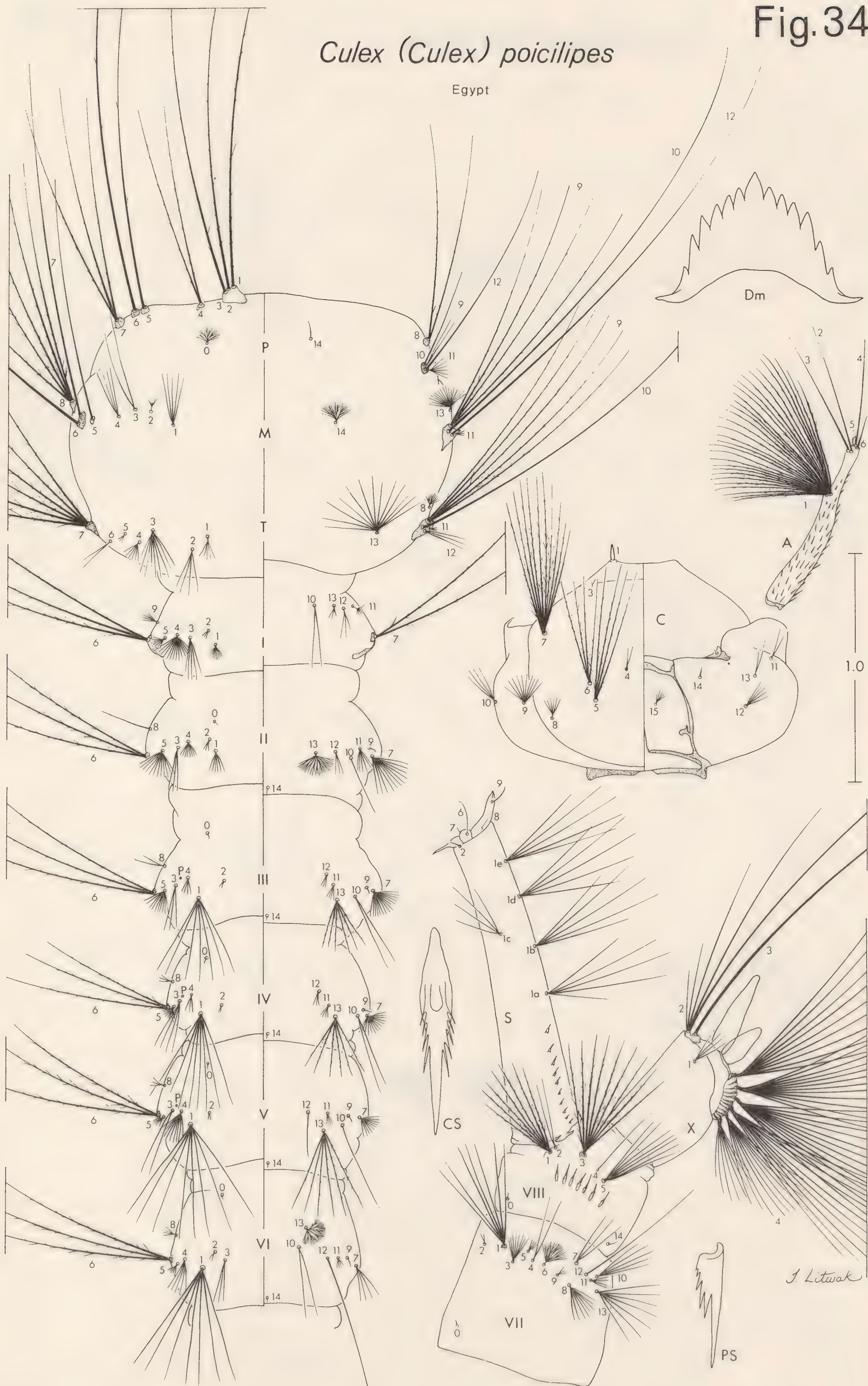


Fig. 34

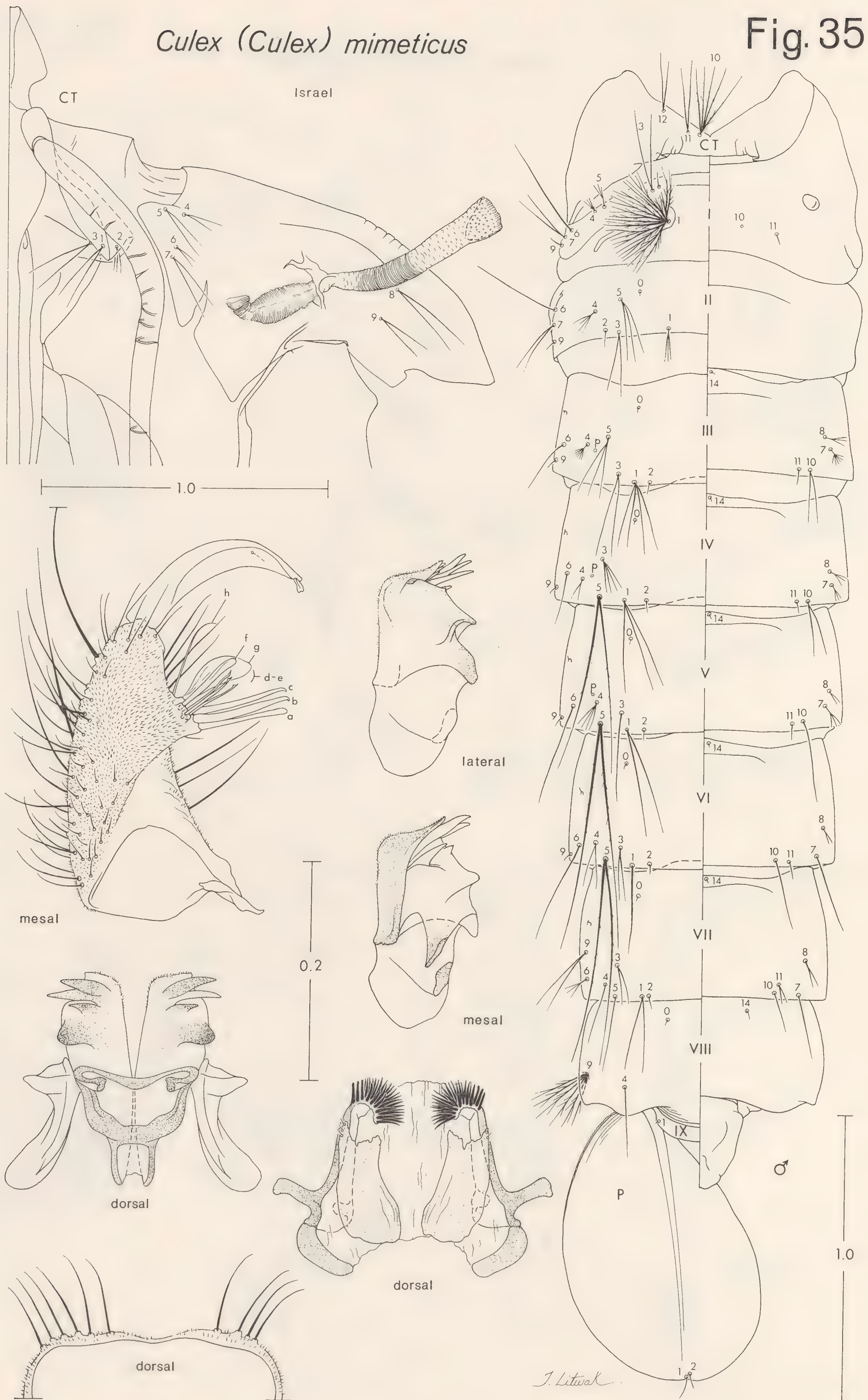
Culex (Culex) poicilipes

Egypt



Culex (Culex) mimeticus

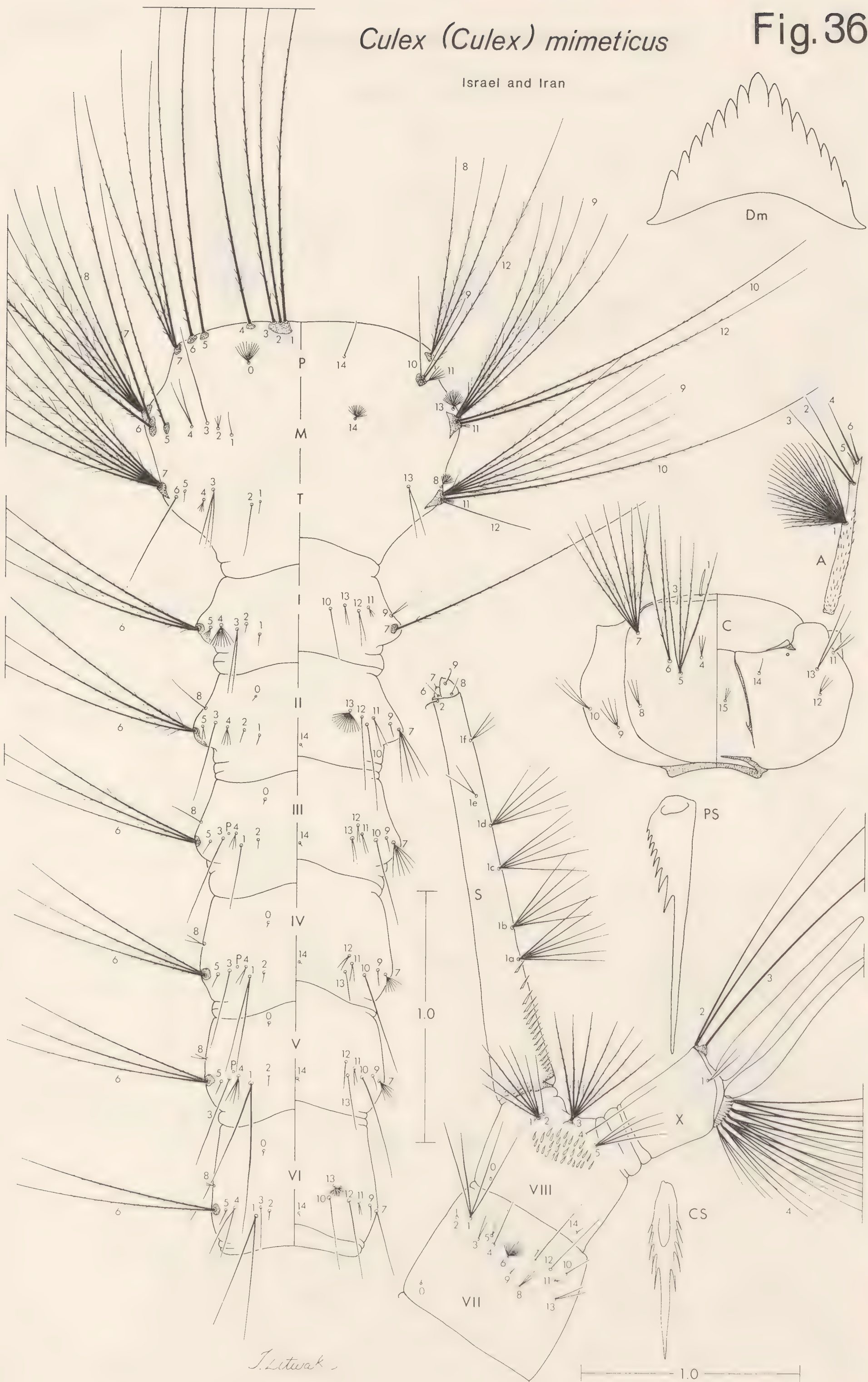
Fig. 35



Culex (Culex) mimeticus

Fig. 36

Israel and Iran

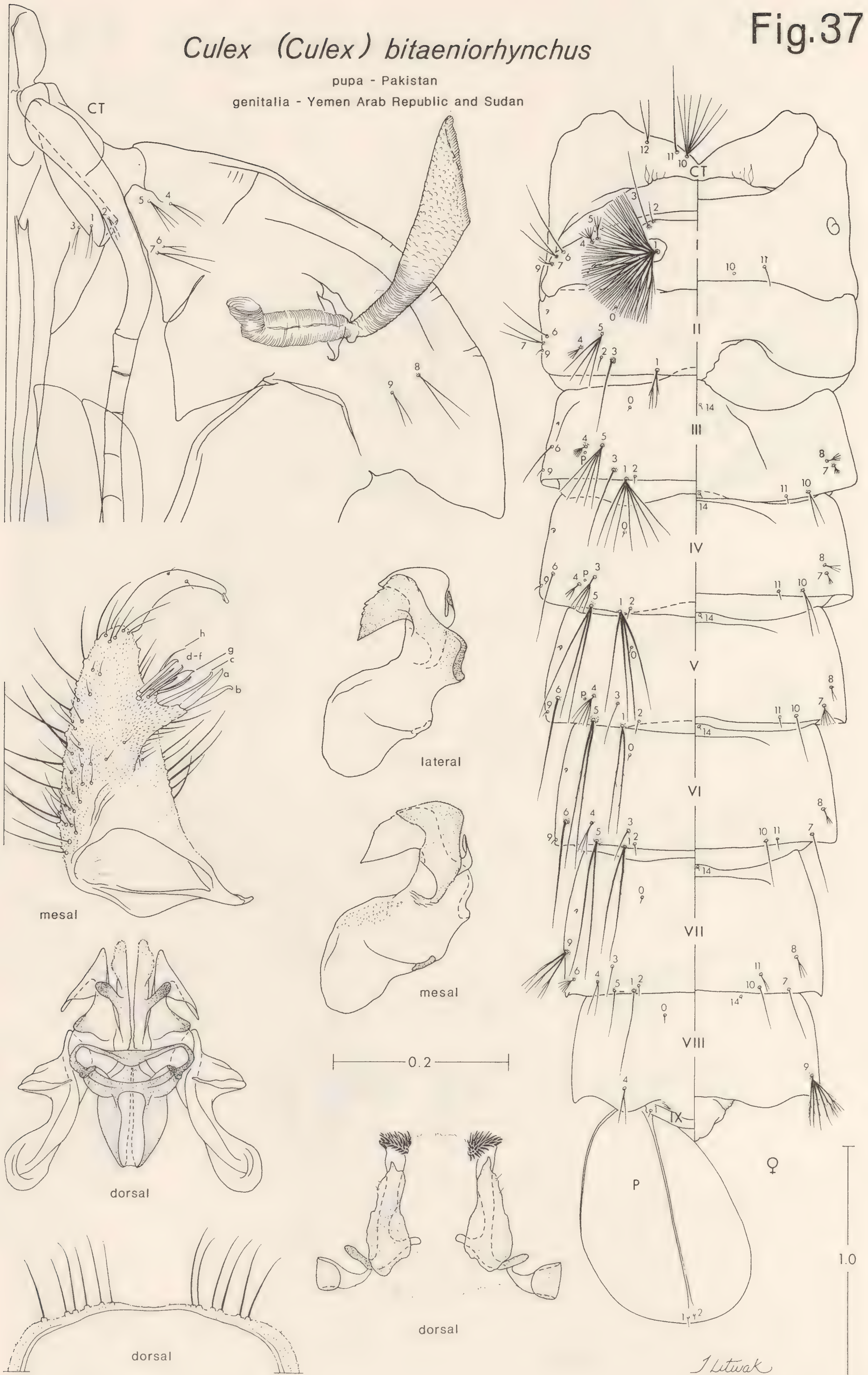


Culex (Culex) bitaeniorhynchus

Fig.37

pupa - Pakistan

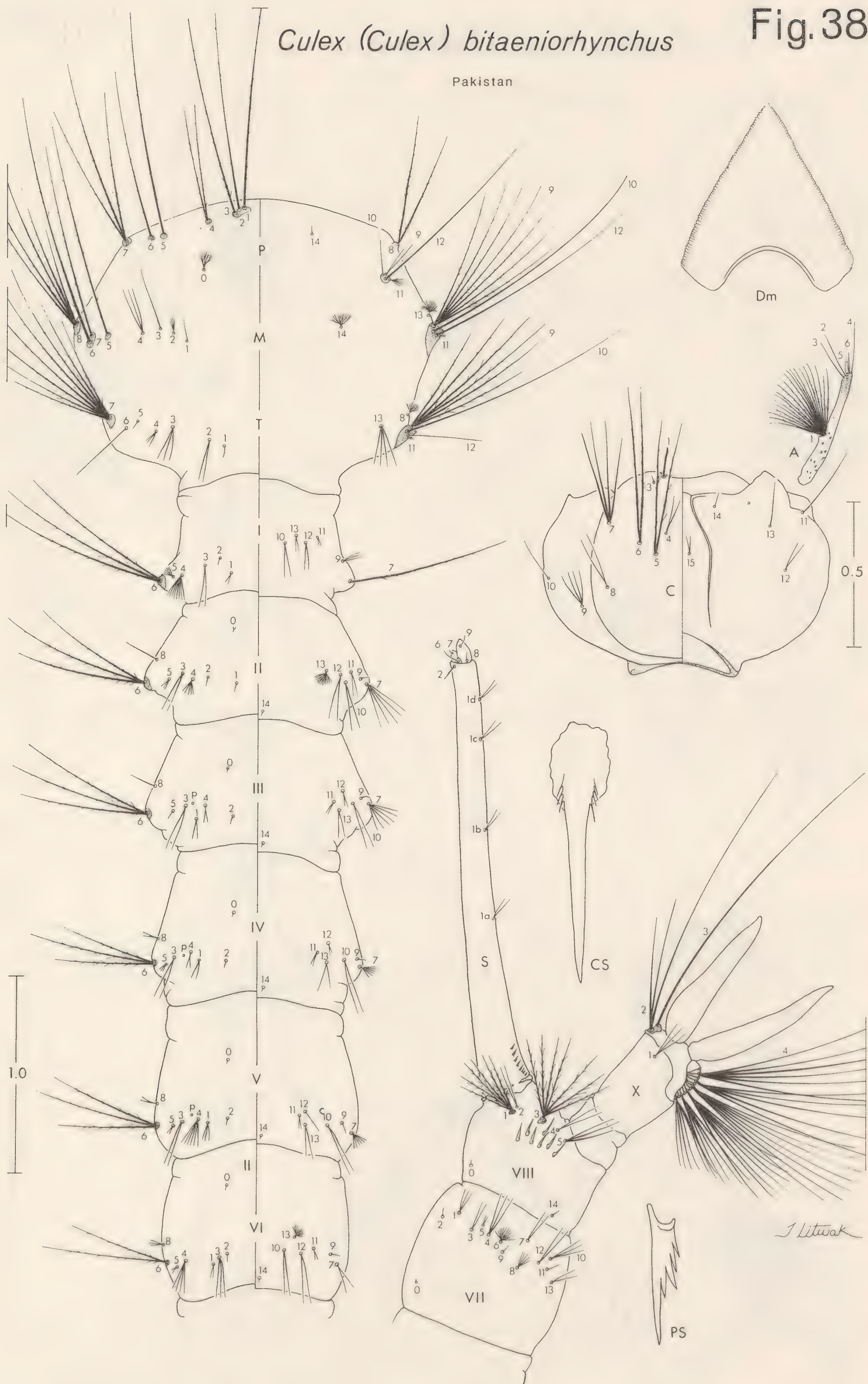
genitalia - Yemen Arab Republic and Sudan



Culex (Culex) bitaeniorhynchus

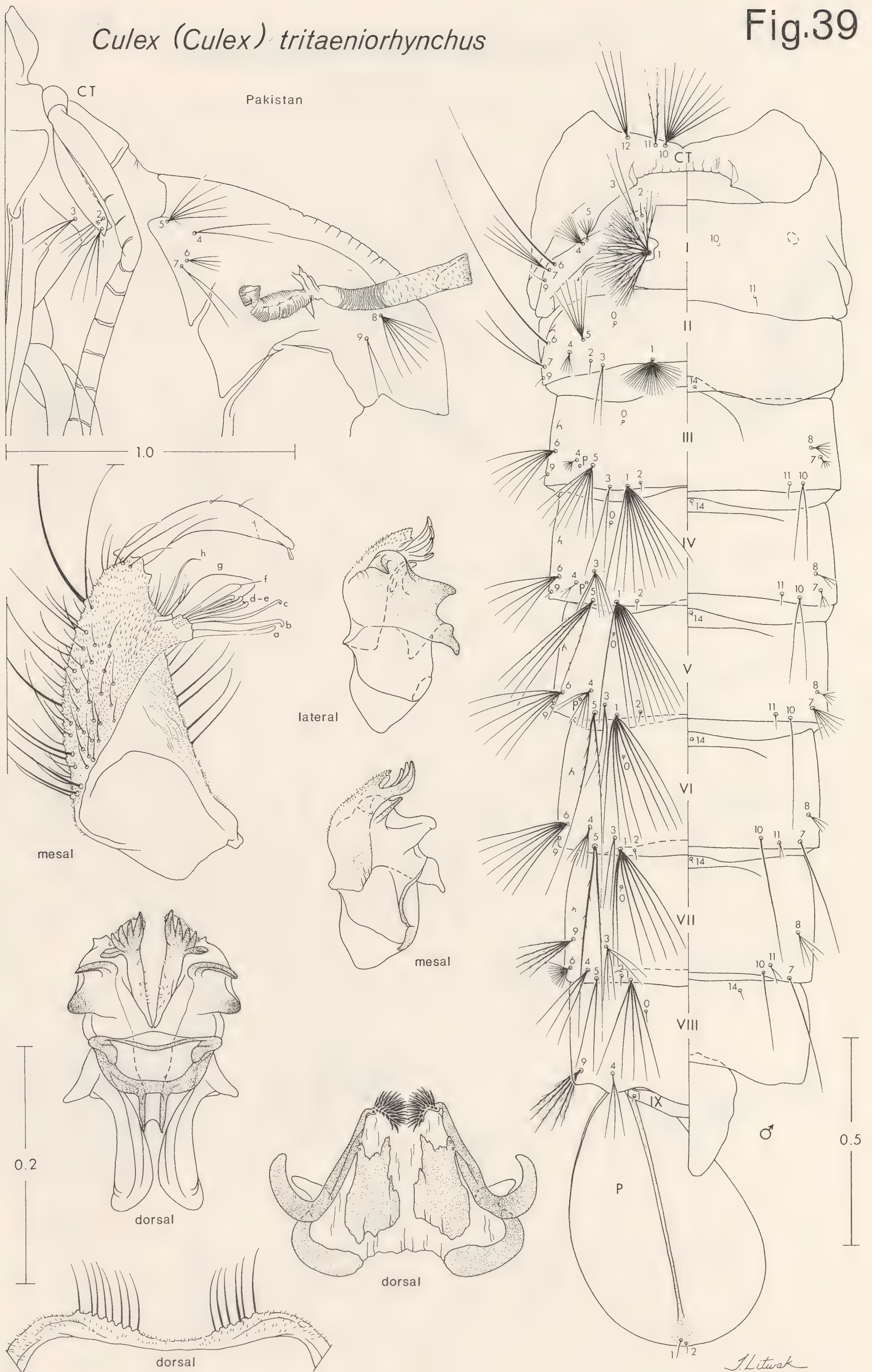
Fig. 38

Pakistan



Culex (Culex) tritaeniorhynchus

Fig.39



Culex (Culex) tritaeniorhynchus

Iran and Saudi Arabia

Fig.40

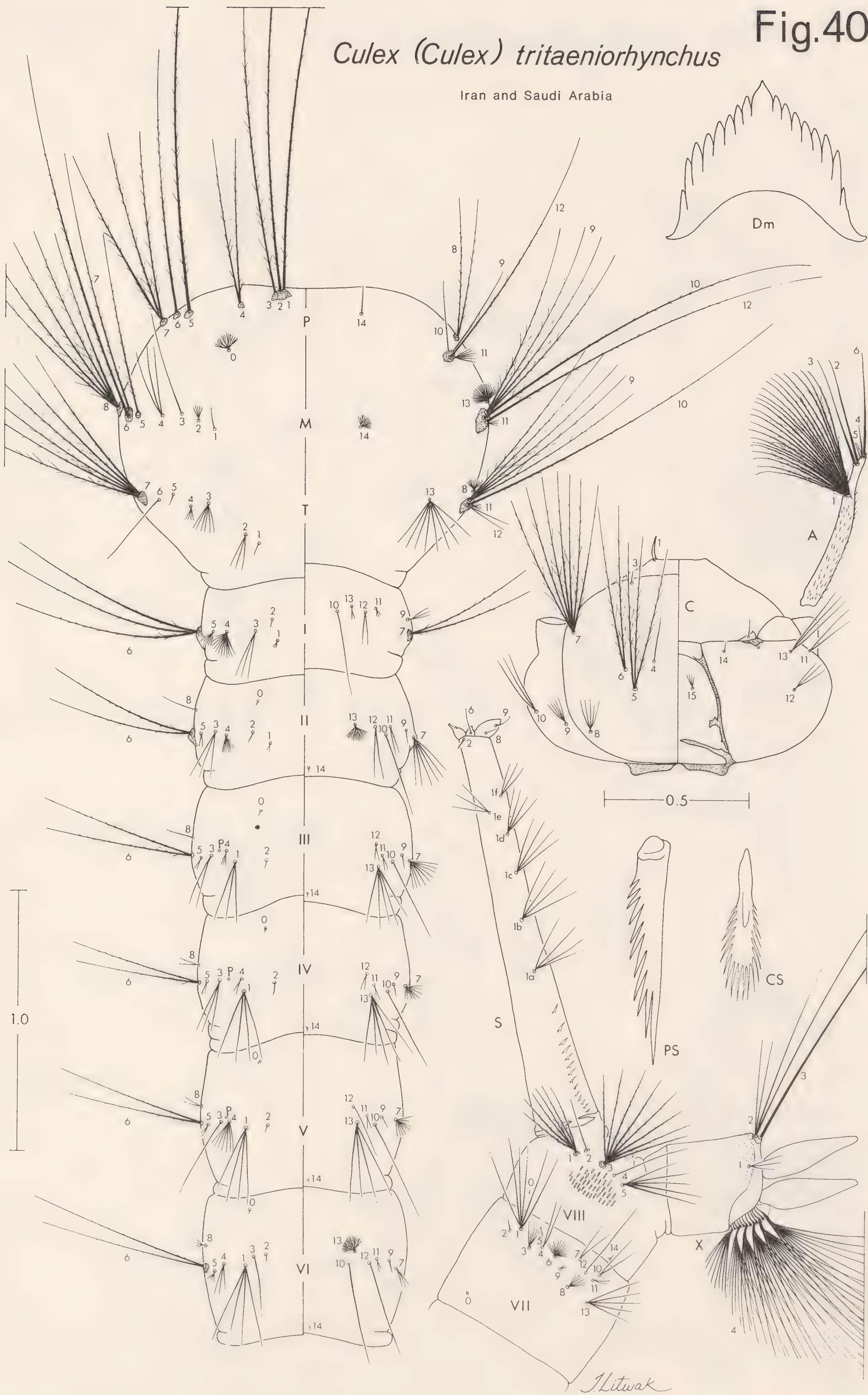
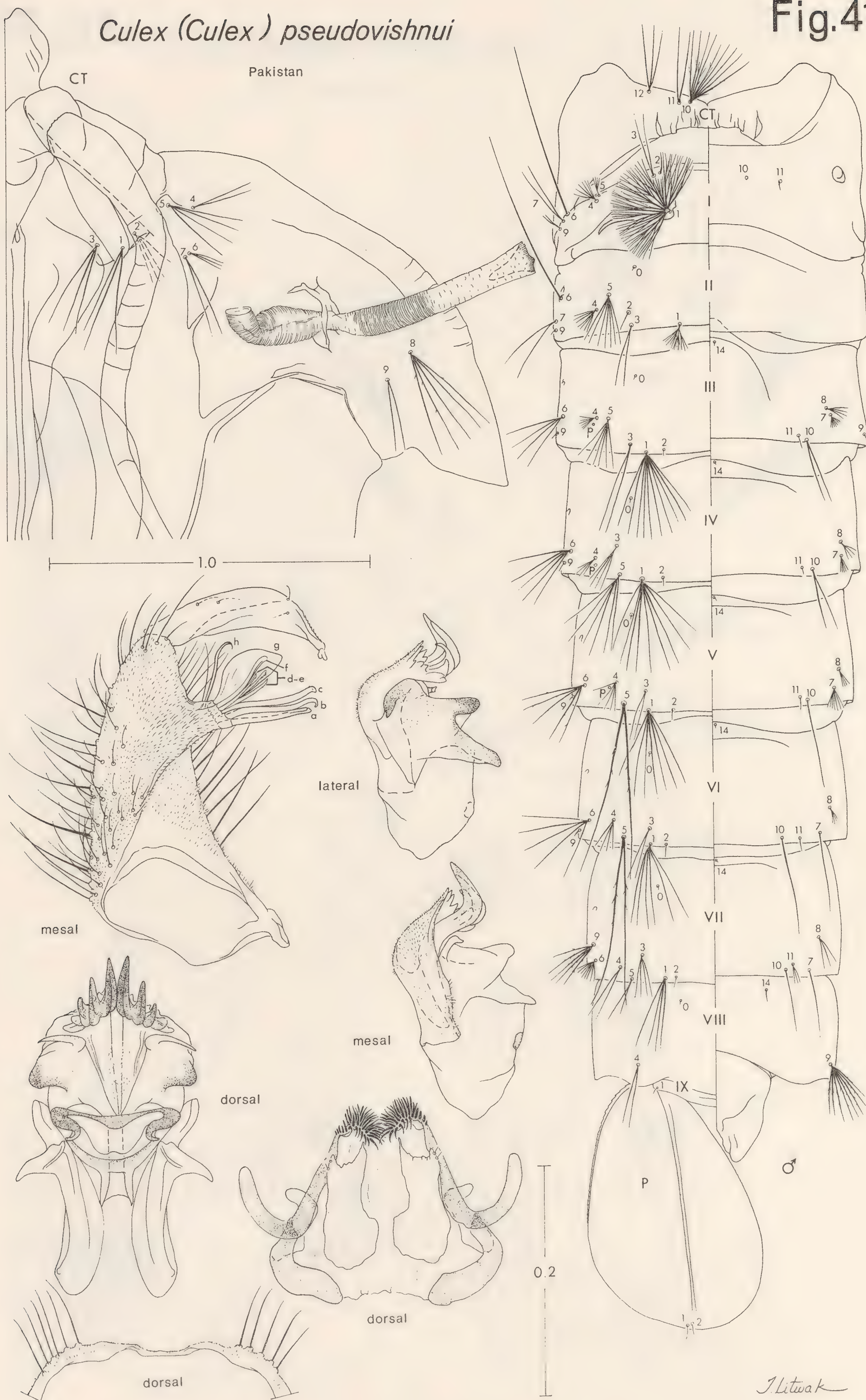


Fig. 41



Culex (Culex) pseudovishnui

Fig.42

Pakistan

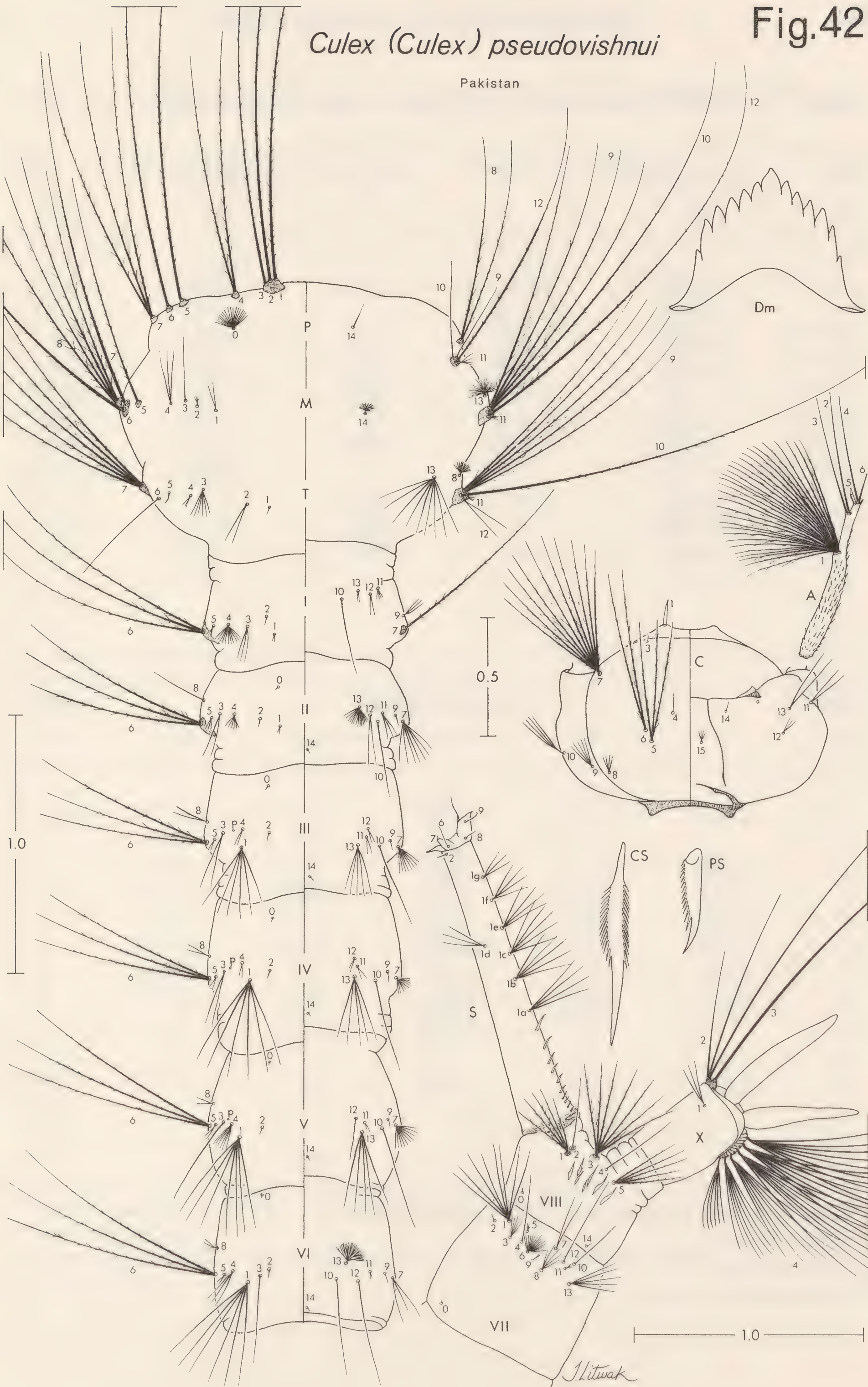


Table 1. Number of branches for pupal setae of *Culex pipiens* Linnaeus.^a

Seta No.	Cephalothorax	Abdominal Segments			
	CT	I	II	III	IV
0	-	-	1	1,2(1)	1
1	3-5(4) ^b	36-75	10-24(18)	5-10(7)	5-9(7)
2	3-5(4)	1-4(1)	1	1	1
3	2-5(3)	2,3(2)	2,3(2)	2,3(2)	3-8(5)
4	2-5(3)	4-8(5)	2-7(4)	3-8(4)	2-5(2)
5	3-7(5)	1-8(5)	4-9(5)	4-10(6)	2-6(4)
6	1-5(3)	1,2(1)	1	2-4(3)	2-5(3)
7	2,3(2)	2-4(2)	2,3(2)	4-8(5)	3-5(3)
8	4-7(4)	-	-	3-5(3)	1-4(3)
9	1,2(2)	1,2(1)	1	1	1
10	5-13(8)	- ^c	2,3(2) ^d	2,3(2)	2
11	2,3(2)	1-3(2)	3-5 ^d	1	1
12	2-5(3)	-	-	-	-
13	-	-	-	-	-
14	-	-	-	1	1

Seta No.	Abdominal Segments					Paddle
	V	VI	VII	VIII	XI	P
0	1	1,2(1)	1	1	-	-
1	4-8(6)	3-7(5)	3-7(5)	-	1	1,2(1)
2	1	1	1,2(1)	-	-	1
3	2,3(2)	2-4(2)	1-3(2)	-	-	-
4	3-6(4)	2-6(4)	1,2(2)	1-3(2)	-	-
5	2,3(2)	1-3(2)	1-3(2)	-	-	-
6	3-6(4)	3-7(4)	3-10(5)	-	-	-
7	3-6(4)	1,2(1)	1,2(1)	-	-	-
8	2-4(3)	2-5(3)	2-5(4)	-	-	-
9	1	1	4-6(5)	5-11(7)	-	-
10	1	1,2(1)	1	-	-	-
11	1,2(1)	1-3(2)	1-4(2)	-	-	-
12	-	-	-	-	-	-
13	-	-	-	-	-	-
14	1	1	1	1,2(1)	-	-

^a Based primarily on specimens from Egypt and Israel.
^b Range (mode).
^c Alveolus only.
^d Infrequently present.

Table 2. Number of branches for pupal setae of *Culex quinquefasciatus* Say.^a

Seta No.	Cephalothorax	Abdominal Segments			
	CT	I	II	III	IV
0	-	-	1	1	1
1	2,3(2) ^b	- ^c	12-22(16)	4-7(5)	4-6(4)
2	3,4(3)	1	1	1	1
3	2,3(3)	2,3(2)	1,2(2)	1,2(2)	3-5(4)
4	2-5(3)	4-7(6)	3,4(3)	3-7(5)	1-4(2)
5	2-4(4)	3-9(5)	3,4(4)	3-5(5)	2-4(2)
6	2-4(2)	1,2(1)	1	2,3(2)	2,3(3)
7	1-3(2)	2,3(2)	1,2(2)	3-7(5)	2-4(3)
8	2,3(3)	-	-	2-7(3)	2-4(3)
9	1,2(2)	1,2(1)	1	1	1
10	4-11(7)	- ^d	-	1-3(2)	1,2(2)
11	1,2(2)	1-3(1)	-	1	1
12	2-4(3)	-	-	-	-
13	-	-	-	-	-
14	-	-	-	1	1

Seta No.	Abdominal Segments					Paddle
	V	VI	VII	VIII	XI	P
0	1	1	1	1	-	-
1	3-5(4)	3-5(4)	3-5(5)	-	1	1
2	1	1	1	-	-	1
3	1,2(2)	2,3(2)	1,2(2)	-	-	-
4	3-5(3)	2-5(3)	2,3(2)	2	-	-
5	1,2(2)	1,2(2)	2	-	-	-
6	2-4(3)	3-5(3)	3-8(4)	-	-	-
7	3-5(4)	1	1	-	-	-
8	2-5(3)	2-4(3)	2-4(3)	-	-	-
9	1	1	3-5(4)	6-8(7)	-	-
10	1	1	1	-	-	-
11	1,2(1)	1-3(2)	2-4(3)	-	-	-
12	-	-	-	-	-	-
13	-	-	-	-	-	-
14	1	1	1	1	-	-

^a Based on specimens from southwestern India.
^b Range (mode).
^c With numerous secondary branches arising from 4-9(6) primary stems.
^d Alveolus only.

Table 3. Number of branches for pupal setae of *Culex vagans* Wiedemann.^a

Seta No.	Cephalothorax	Abdominal Segments			
	CT	I	II	III	IV
0	-	-	1	1	1
1	3,4(4) ^b	- ^c	9-16(10)	6-11(10)	5-10(8)
2	3,4(4)	1,2(1)	1	1	1
3	2,3(3)	2-4(2)	2,3(2)	1,2(2)	4-7(7)
4	3,4(3)	4-7(6)	2-5(4)	4-7(5)	2-4(3)
5	4-7(4)	2-6(3)	4-6(5)	5-8(6)	2-4(3)
6	2-4(3)	1	1	2-5(3)	2-5(4)
7	2	2,3(2)	1,2(2)	4-9(6)	3-5(4)
8	3-9(7)	-	-	3-5(3)	2-4(2)
9	2-4(2)	1,2(1)	1	1	1
10	5-14(7)	- ^d	-	1,2(2)	1,2(2)
11	1,2(2)	1,2(1)	-	1	1
12	4-6(4)	-	-	-	-
13	-	-	-	-	-
14	-	-	-	1	1

Seta No.	Abdominal Segments					Paddle
	V	VI	VII	VIII	XI	P
0	1	1	1	1	-	-
1	5-9(7)	5-7(6)	4-7(5)	-	1	1,2(1)
2	1	1	1	-	-	1
3	1,2(2)	2	1,2(2)	-	-	-
4	3-6(4)	3,4(4)	1,2(2)	1,2(2)	-	-
5	1,2(2)	2	2-5(2)	-	-	-
6	3-6(3)	4,5(4)	4-7(5)	-	-	-
7	4-6(4)	1,2(1)	1	-	-	-
8	1-3(2)	2,3(2)	2,3(3)	-	-	-
9	1	1	3-6(4)	7-11(8)	-	-
10	1	1	1	-	-	-
11	1	1,2(1)	2,3(2)	-	-	-
12	-	-	-	-	-	-
13	-	-	-	-	-	-
14	1	1	1	1	-	-

^a Based on specimens from Pakistan.
^b Range (mode).
^c With numerous secondary branches arising from 6-10(7) primary stems.
^d Alveolus only.

Table 4. Number of branches for pupal setae of *Culex torrentium* Martini.^a

Seta No.	Cephalothorax	Abdominal Segments			
	CT	I	II	III	IV
0	-	-	1	1	1
1	2-4(3) ^b	- ^c	12-16(15)	6-10(7)	5-9(5)
2	2-5(4)	1	1	1	1
3	2,3(2)	2,3(2)	2,3(2)	2	2-6(4)
4	3-5(3)	3-5(3)	3-5(3)	4,5(4)	1-3(1)
5	3-6(4)	3-5(4)	3,4(3)	2-6(5)	3,4(3)
6	3-5(3)	1	1,2(1)	2,3(2)	2,3(3)
7	2,3(2)	2,3(2)	2	5,6(5)	2-5(3)
8	1-4(3)	-	-	2,3(3)	2-4(2)
9	2	1,2(1)	1	1	1
10	5-12(5)	- ^d	-	2	1,2(2)
11	2,3(2)	1,2(1)	-	1	1
12	2-4(3)	-	-	-	-
13	-	-	-	-	-
14	-	-	-	1	1

Seta No.	Abdominal Segments					Paddle
	V	VI	VII	VIII	XI	P
0	1	1	1	1	-	-
1	4-9(5)	2-6(4)	2-5(4)	-	1	1
2	1	1,2(1)	1	-	-	1,2(1)
3	1,2(2)	1,2(2)	1,2(2)	-	-	-
4	2-6(4)	2,3(2)	1,2(2)	1,2(2)	-	-
5	2	2	1,2(2)	-	-	-
6	3,4(3)	2-5(3)	3-6(6)	-	-	-
7	3-7(5)	1	1	-	-	-
8	2-5(3)	2-4(3)	2-4(3)	-	-	-
9	1	1	3-5(4)	5-10(7)	-	-
10	1	1	1	-	-	-
11	1	1,2(1)	1-3(2)	-	-	-
12	-	-	-	-	-	-
13	-	-	-	-	-	-
14	1	1	1	1	-	-

^a Based on specimens from Sweden.
^b Range (mode).
^c With numerous secondary branches arising from 5,6(5) primary stems.
^d Alveolus only.

Table 5. Number of branches for pupal setae of *Culex decens* Theobald.^a

Seta No.	Cephalothorax	Abdominal Segments			
	CT	I	II	III	IV
0	-	-	1	1	1
1	3-5(3) ^b	- ^c	25-32(30)	6-9(8)	4-7(6)
2	3-5(4)	1-3(1)	1	1	1
3	3,4(3)	2	2	2	4-6(5)
4	3,4(3)	4-7(5)	3-6(4)	3-6(4)	2,3(2)
5	3-6(4)	4-6(5)	3-6(5)	4-6(5)	3,4(3)
6	3,4(4)	1,2(1)	1-3(1)	2,3(2)	2-4(3)
7	2	2,3(2)	2	3-6(6)	2-5(3)
8	3-6(4)	-	-	3-6(4)	3,4(3)
9	2,3(2)	1-3(2)	1	1	1
10	5-10(7)	- ^d	-	1,2(2)	2
11	2,3(2)	1-3(1)	-	1,2(1)	1,2(1)
12	3-5(4)	-	-	-	-
13	-	-	-	-	-
14	-	-	-	1	1

Seta No.	Abdominal Segments					Paddle
	V	VI	VII	VIII	XI	P
0	1	1	1	1	-	-
1	3-5(5)	4-6(4)	3,4(4)	-	1	1,2(1)
2	1	1	1	-	-	1
3	2	2	2,3(2)	-	-	-
4	3-5(4)	2-4(4)	2	2	-	-
5	2	2	2	-	-	-
6	3,4(3)	3,4(3)	4-9(6)	-	-	-
7	3,4(4)	1	1	-	-	-
8	2,3(3)	3,4(4)	3-5(4)	-	-	-
9	1	1	2-5(4)	5-8(8)	-	-
10	1	1	1	-	-	-
11	1,2(2)	1-3(2)	1-4(2)	-	-	-
12	-	-	-	-	-	-
13	-	-	-	-	-	-
14	1	1	1	1	-	-

^a Based on specimens from the Yemen Arab Republic.^b Range (mode).^c With numerous secondary branches arising from 6-9(7) primary stems.^d Alveolus only.

Table 6. Number of branches for pupal setae of *Culex antennatus* (Becker).^a

Seta No.	Cephalothorax	Abdominal Segments			
	CT	I	II	III	IV
0	-	-	1	1	1
1	3-5(3) ^b	- ^c	7-42(31)	6-13(7)	5-14(8)
2	3-5(4)	1	1	1	1
3	2-5(3)	2-5(2)	2,3(2)	2-4(2)	5-8(6)
4	1-4(3)	5-9(7)	3-6(4)	2-8(4)	2-6(4)
5	4-8(6)	4-10(8)	5-7(6)	6,7(7)	4-6(5)
6	2-5(4)	1	1	3-6(4)	3-6(3)
7	2,3(2)	2,3(2)	1,2(2)	2-8(6)	2-6(3)
8	4-9(7)	-	-	2-5(4)	2-4(4)
9	2-4(3)	1-3(2)	1	1	1
10	3-10(9)	- ^d	-	2	2
11	1,2(2)	1	-	1	1
12	2-5(5)	-	-	-	-
13	-	-	-	-	-
14	-	-	-	1	1

Seta No.	Abdominal Segments					Paddle
	V	VI	VII	VIII	XI	P
0	1	1	1	1	-	-
1	5-9(6)	4-8(7)	4-7(5)	-	1,2(1)	1,2(1)
2	1	1	1	-	-	1,2(1)
3	2-4(3)	2,3(3)	3-5(5)	-	-	-
4	4-8(4)	3-6(4)	2	2,3(2)	-	-
5	2,3(2)	2	1,2(2)	-	-	-
6	3-6(6)	3-6(5)	4-12(10)	-	-	-
7	4-8(6)	1	1	-	-	-
8	2-5(4)	2-5(4)	2-4(3)	-	-	-
9	1	1	2-4(3)	6-8(8)	-	-
10	1	1	1	-	-	-
11	1,2(1)	1-3(2)	1-5(2)	-	-	-
12	-	-	-	-	-	-
13	-	-	-	-	-	-
14	1	1	1	1	-	-

^a Based on specimens from Egypt.
^b Range (mode).
^c With numerous secondary branches arising from 7-10(8) primary stems.
^d Alveolus only.

Table 7. Number of branches for pupal setae of *Culex univittatus* Theobald.^a

Seta No.	Cephalothorax	Abdominal Segments			
	CT	I	II	III	IV
0	-	-	1	1	1
1	2-3(3) ^b	- ^c	14-20(17)	7-11(9)	5-8(6)
2	3-6(4)	1	1	1	1
3	3,4(3)	1,2(2)	1,2(2)	2	5-8(6)
4	3-5(3)	5-8(5)	3-5(4)	4-7(5)	1-3(2)
5	3-6(4)	6-9(7)	5-7(5)	5-9(6)	5,6(6)
6	3-5(5)	1	1	2-4(4)	3,4(4)
7	2	2,3(2)	2,3(2)	5-9(6)	2,3(3)
8	3-5(5)	-	-	3-5(3)	2-4(3)
9	2,3(2)	2,3(2)	1	1	1
10	4-10(4)	- ^d	-	2	1,2(2)
11	1,2(2)	2	-	1	1
12	3	-	-	-	-
13	-	-	-	-	-
14	-	-	-	1	1

Seta No.	Abdominal Segments					Paddle
	V	VI	VII	VIII	XI	P
0	1	1	1	1	-	-
1	5-8(7)	5-7(5)	3-5(4)	-	1	1
2	1	1	1	-	-	1
3	2,3(2)	2,3(3)	3-5(4)	-	-	-
4	4-6(5)	3-5(4)	2	2,3(2)	-	-
5	3,4(3)	2,3(3)	2	-	-	-
6	4,5(4)	3-5(4)	5-7(6)	-	-	-
7	4-7(6)	1	1	-	-	-
8	1-4(3)	2-4(3)	2-4(3)	-	-	-
9	1	1	3,4(4)	7,8(8)	-	-
10	1	1	1	-	-	-
11	1	1	1	-	-	-
12	-	-	-	-	-	-
13	-	-	-	-	-	-
14	1	1	1	1	-	-

^a Based on specimens from South Africa.
^b Range (mode).
^c With numerous secondary branches arising from 8-12(9) primary stems.
^d Alveolus only.

Table 8. Number of branches for pupal setae of *Culex perexiguus* Theobald.^a

Seta No.	Cephalothorax	Abdominal Segments			
	CT	I	II	III	IV
0	-	-	1	1	1
1	3,4(3) ^b	- ^c	13-22(16)	7-12(8)	5-7(5)
2	3-5(3)	1	1	1	1
3	2-4(3)	2	2	2	4-7(5)
4	2,3(3)	5-7(5)	3-6(5)	3-7(5)	2,3(2)
5	3-5(4)	4-7(6)	5-7(6)	6-8(6)	4-6(5)
6	2-4(3)	1	1	2-4(3)	3-5(3)
7	2	1-3(2)	1-3(1)	4-7(6)	2-5(3)
8	4-6(4)	-	-	3-6(3)	2-4(3)
9	2,3(2)	1,2(2)	1	1	1
10	4-9(6)	- ^d	-	2-4(2)	2
11	1,2(2)	1	-	1	1
12	2-4(2)	-	-	-	-
13	-	-	-	-	-
14	-	-	-	1	1

Seta No.	Abdominal Segments					Paddle
	V	VI	VII	VIII	XI	P
0	1	1	1	1	-	-
1	4-8(5)	4-6(5)	4,5(4)	-	1	1
2	1	1	1,2(1)	-	-	1
3	2	2	3,4(4)	-	-	-
4	3-5(4)	2-4(3)	1,2(2)	2,3(2)	-	-
5	2-4(3)	2,3(2)	2	-	-	-
6	3,4(3)	3-5(3)	4-6(5)	-	-	-
7	2-5(4)	1	1	-	-	-
8	2,3(3)	2-4(3)	2-4(3)	-	-	-
9	1	1	3-6(3)	5-8(7)	-	-
10	1,2(1)	1	1	-	-	-
11	1	1,2(1)	1-3(2)	-	-	-
12	-	-	-	-	-	-
13	-	-	-	-	-	-
14	1	1	1	1,2(1)	-	-

^a Based on specimens from Egypt.
^b Range (mode).
^c With numerous secondary branches arising from 6-10(8) primary stems.
^d Alveolus only.

Table 9. Number of branches for pupal setae of *Culex theileri* Theobald.^a

Seta No.	Cephalothorax	Abdominal Segments			
	CT	I	II	III	IV
0	-	-	1	1	1
1	3,4(4) ^b	- ^c	7-16(10)	6-13(10)	5-8(7)
2	3-5(4)	1,2(1)	1	1	1
3	3,4(3)	2	2	2,3(2)	5-7(6)
4	2-5(4)	5-8(6)	4-8(4)	5-8(7)	2,3(2)
5	2-6(4)	3-9(4)	5-10(6)	7-10(9)	2-4(4)
6	3,4(3)	1	1	2-5(3)	2-6(3)
7	1,2(2)	2,3(2)	2	5-7(7)	2-5(3)
8	4,5(5)	-	-	3-7(4)	3-5(4)
9	2,3(2)	1-3(2)	1	1	1
10	2-4(2)	- ^d	-	1,2(2)	1,2(2)
11	2	1,2(2)	-	1	1
12	3-5(5)	-	-	-	-
13	-	-	-	-	-
14	-	-	-	1	1

Seta No.	Abdominal Segments					Paddle
	V	VI	VII	VIII	XI	P
0	1	1	1	1,2(1)	-	-
1	4-7(6)	3-6(5)	3-6(4)	-	1	1,2(1)
2	1	1	1	-	-	1,2(1)
3	2,3(2)	1,2(2)	2-5(4)	-	-	-
4	5,6(6)	4,5(4)	2	2,3(2)	-	-
5	2	2	2	-	-	-
6	2-6(3)	3-6(3)	6-9(8)	-	-	-
7	4-7(6)	1	1	-	-	-
8	2-6(5)	2-6(5)	3-5(4)	-	-	-
9	1	1	4-8(4)	5-10(6)	-	-
10	1	1,2(1)	1	-	-	-
11	1,2(2)	1-3(2)	2,3(2)	-	-	-
12	-	-	-	-	-	-
13	-	-	-	-	-	-
14	1	1	1	1	-	-

^a Based on specimens from Egypt and the Yemen Arab Republic.^b Range (mode).^c With numerous secondary branches arising from 7-10(7) primary stems.^d Alveolus only.

Table 10. Number of branches for pupal setae of *Culex laticinctus* Edwards.^a

Seta No.	Cephalothorax	Abdominal Segments			
	CT	I	II	III	IV
0	-	-	1	1	1
1	2,3(2) ^b	- ^c	7-14(9)	4-7(5)	4
2	2-4(3)	1-3(1)	1	1,2(1)	1
3	2,3(2)	2	2,3(2)	2,3(2)	4-7(7)
4	4-6(4)	6-9(6)	3-6(4)	4,5(4)	1-3(2)
5	3-8(4)	5-8(5)	4-7(5)	4-8(5)	2-5(4)
6	4-6(4)	1,2(1)	1,2(?)	3,4(3)	2,3(3)
7	2,3(2)	2,3(3)	1,2(2)	4-9(8)	3-5(4)
8	4-6(4)	-	-	4,5(4)	2-4(3)
9	2,3(2)	2	1	1	1
10	4-10(7)	- ^d	1-3 ^e	1-3(2)	2,3(2)
11	1,2(2)	1,2(1)	- ^c	1	1
12	3,4(3)	-	-	-	-
13	-	-	-	-	-
14	-	-	-	1	1

Seta No.	Abdominal Segments					Paddle
	V	VI	VII	VIII	XI	P
0	1	1	1	1	-	-
1	3-5(4)	3,4(4)	3,4(3)	-	1	1
2	1	1,2(1)	1,2(1)	-	-	1
3	1,2(2)	1,2(2)	2-4(3)	-	-	-
4	3-5(4)	2-4(3)	1,2(2)	2,3(2)	-	-
5	2	2,3(2)	1,2(2)	-	-	-
6	2-4(3)	2-4(3)	4-8(6)	-	-	-
7	4-6(4)	1	1	-	-	-
8	1-3(2)	3,4(3)	3-5(4)	-	-	-
9	1	1	3-5(4)	6-13(6)	-	-
10	1,2(1)	1	1	-	-	-
11	1	1	1-3(1)	-	-	-
12	-	-	-	-	-	-
13	-	-	-	-	-	-
14	1	1	1	1	-	-

^a Based on specimens from the Yemen Arab Republic.
^b Range (mode).
^c With numerous secondary branches arising from 7-9(7) primary stems.
^d Alveolus only.
^e Frequently absent, often present on one side only.

Table 11. Number of branches for pupal setae of *Culex mattinglyi* Knight.^a

Seta No.	Cephalothorax	Abdominal Segments				
	CT	I	II	III	IV	
0	-	-	1/1	1/1	1/1	
1	3/- ^b	9/6 ^c	17/14	14/10	7/7	
2	3/3	1/1	1/1	1/1	1/1	
3	3/-	2/2	2/2	2/2	4/2	
4	3/-	5/4	3/2	2/3	1/1	
5	7/7	6/6	2/2	3/2	2/2	
6	3/2	7/3	5/5	5/5	5/3	
7	2/-	3/4	1/1	5/3	1/1	
8	2/2	-	-	1/1	2/1	
9	2/2	3/2	1/1	1/1	1/1	
10	8/10	- ^d	10/9	2/2	2/2	
11	4/4	1/-	-	1/1	1/1	
12	2/2	-	-	-	-	
13	3/2	-	-	-	-	
14	-	-	-	1/1	1/1	

Seta No.	Abdominal Segments					Paddle
	V	VI	VII	VIII	XI	P
0	1/1	1/1	1/1	1/1	-	-
1	4/4	3/4	3/2	-	1/1	1/1
2	1/1	1/1	1/1	-	-	1/1
3	2/1	2/2	1/2	-	-	-
4	2/3	2/2	1/1	1/1	-	-
5	1/1	1/1	2/4	-	-	-
6	3/4	4/3	-/9	-	-	-
7	4/2	-/1	-/1	-	-	-
8	3/2	2/3	-/3	-	-	-
9	1/1	1/1	-/2	-/12	-	-
10	1/2	-/1	1/1	-	-	-
11	1/1	1/1	1/1	-	-	-
12	-	-	-	-	-	-
13	-	-	-	-	-	-
14	1/1	1/1	1/1	1/1	-	-

^a Based on a single specimen in the type series from the Yemen Arab Republic.
^b Branches of setae on right/left sides.
^c Number of primary stems, with numerous secondary branches.
^d Alveolus only.

Table 12. Number of branches for pupal setae of *Culex simpsoni* Theobald.^a

Seta No.	Cephalothorax	Abdominal Segments			
	CT	I	II	III	IV
0	-	-	1	1	1
1	4,5(4) ^b	- ^c	12-19(16)	12-15(12)	8-12(12)
2	4-6(5)	1	1	1	1
3	3	2	2	2	4-7(5)
4	3-5(4)	4-6(6)	3-7(6)	4-7(5)	2-4(2)
5	4-6(5)	2-6(5)	5-7(6)	7-9(7)	4-6(5)
6	2-6(4)	1	1	4-6(5)	4-6(5)
7	2,3(2)	1,2(2)	2	5-8(7)	3-5(3)
8	4-6(5)	-	-	3-6(4)	3,4(3)
9	3,4(3)	1-3(2)	1	1	1
10	3-8(8)	?	-	2	2
11	2	?	-	1	1
12	3-5(4)	-	-	-	-
13	-	-	-	-	-
14	-	-	-	1	1

Seta No.	Abdominal Segments					Paddle
	V	VI	VII	VIII	XI	P
0	1	1	1	1	-	-
1	7-9(8)	3-7(7)	3,4(4)	-	1	1
2	1	1	1	-	-	1
3	1-3(2)	2,3(2)	2-4(4)	-	-	-
4	5,6(6)	3-5(4)	2,3(2)	2,3(3)	-	-
5	2,3(2)	2	2,3(2)	-	-	-
6	4-6(5)	4-6(5)	6-8(7)	-	-	-
7	4-7(6)	1	1	-	-	-
8	3,4(4)	3-5(4)	3-5(4)	-	-	-
9	1	1	4-6(4)	7-9(8)	-	-
10	1-3(1)	1	1	-	-	-
11	1	1,2(1)	2,3(2)	-	-	-
12	-	-	-	-	-	-
13	-	-	-	-	-	-
14	1	1	1	1	-	-

^a Based on specimens from Ethiopia and Tanzania.
^b Range (mode).
^c With numerous secondary branches arising from 6-9(8) primary stems.

Table 13. Number of branches for pupal setae of *Culex sinaiticus* Kirkpatrick.^a

Seta No.	Cephalothorax	Abdominal Segments			
	CT	I	II	III	IV
0	-	-	1	1	1
1	3,4(4) ^b	- ^c	15-22(18)	8-16(11)	7-12(7)
2	4,5(5)	1,2(1)	1,2(1)	1	1
3	2,4(2)	1,2(2)	1,2(2)	2	5-7(5)
4	2-4(4)	4-6(6)	4-7(6)	4-6(5)	1-3(2)
5	3-6(5)	2-5(3)	5,6(5)	5-8(6)	5,6(6)
6	3-5(4)	1	1	3-5(4)	3-6(5)
7	2	2	1,2(2)	4-7(6)	2-5(3)
8	4-6(5)	-	-	2-6(4)	2-5(3)
9	2,3(3)	1-3(2)	1	1	1
10	4-7(5)	- ^d	-	2	1,2(2)
11	2	1	-	1,2(1)	1,2(1)
12	3,4(4)	-	-	-	-
13	-	-	-	-	-
14	-	-	-	1	1

Seta No.	Abdominal Segments					Paddle
	V	VI	VII	VIII	XI	P
0	1	1	1	1	-	-
1	5-10(7)	5-7(5)	3-5(4)	-	1	1
2	1	1	1,2(1)	-	-	1
3	1-3(2)	2	3,4(4)	-	-	-
4	4-6(5)	3,4(3)	2,3(2)	2,3(2)	-	-
5	2,3(2)	2	2	-	-	-
6	3-5(5)	4-6(5)	5-10(6)	-	-	-
7	4-6(6)	1	1	-	-	-
8	2-4(4)	3-5(3)	3-5(4)	-	-	-
9	1	1	3-5(4)	6-10(7)	-	-
10	1	1	1	-	-	-
11	1,2(1)	1-3(1)	1-3(2)	-	-	-
12	-	-	-	-	-	-
13	-	-	-	-	-	-
14	1	1	1	1	-	-

^a Based on specimens from Egypt (Sinai) and Israel.
^b Range (mode).
^c With numerous secondary branches arising from 5-8(8) primary stems.
^d Alveolus only.

Table 14. Number of branches for pupal setae of *Culex duttoni* Theobald.^a

Seta No.	Cephalothorax	Abdominal Segments			
	CT	I	II	III	IV
0	-	-	1	1	1
1	2,3(2) ^b	- ^c	17-26(18)	4-6(4)	2-6(4)
2	2,3(2)	1,2(1)	1,2(1)	1	1
3	2-4(3)	2	1,2(2)	2	4-8(6)
4	2-5(3)	6-11(9)	4-7(6)	3-6(4)	1-3(2)
5	2-6(4)	3-6(4)	3-5(3)	4,5(4)	1-4(4)
6	2-4(3)	1,2(1)	1,2(1)	1,2(1)	1,2(1)
7	2	2-5(3)	3,4(4)	3-8(4)	3-5(4)
8	2,3(2)	-	-	2-5(4)	1-4(2)
9	2,3(2)	1,2(2)	1	1	1
10	5-13(8)	- ^d	-	2,3(2)	2
11	2-5(3)	2-5(2)	-	1-3(1)	1,2(1)
12	2-5(3)	-	-	-	-
13	-	-	-	-	-
14	-	-	-	1	1

Seta No.	Abdominal Segments					Paddle
	V	VI	VII	VIII	XI	P
0	1	1	1	1	-	-
1	1-4(2)	2,3(2)	2-4(2)	-	1	1,2(1)
2	1	1	1	-	-	0,2(0)
3	1,2(2)	1-3(2)	2	-	-	-
4	4-6(5)	3-5(4)	2	2-4(2)	-	-
5	1-3(1)	1	1-3(2)	-	-	-
6	1-3(1)	1-3(3)	6-16(11)	-	-	-
7	4-9(6)	1	1	-	-	-
8	2-4(4)	2-5(4)	4-9(4)	-	-	-
9	1	1	3-6(3)	7-11(10)	-	-
10	1	1	1,2(1)	-	-	-
11	1-3(1)	1-3(1)	2,3(2)	-	-	-
12	-	-	-	-	-	-
13	-	-	-	-	-	-
14	1	1	1	1	-	-

^a Based on specimens from Uganda and Cameroon.
^b Range (mode).
^c With numerous secondary branches arising from 7-12(7) primary stems.
^d Alveolus only.

Table 15. Number of branches for pupal setae of *Culex sitiens* Wiedemann.^a

Seta No.	Cephalothorax	Abdominal Segments			
	CT	I	II	III	IV
0	-	-	1	1,2(1)	1,2(1)
1	2,3(2) ^b	- ^c	4-10(6)	5-8(6)	3-5(5)
2	3,4(4)	1	1	1	1
3	1-3(2)	2,3(2)	1,2(2)	2	5-8(6)
4	2-4(3)	5-8(7)	4-6(4)	4-7(5)	2,3(3)
5	3,4(3)	4-7(6)	4,5(4)	4-6(5)	2,3(2)
6	2,3(2)	1	1	1,2(1)	1,2(2)
7	2	3	2,3(2)	5-9(7)	3-5(5)
8	2	-	-	3-5(3)	3,4(3)
9	2,3(2)	1-3(2)	1	1	1
10	5-9(7)	- ^d	-	1,2(2)	1-3(2)
11	2-4(3)	1,2(1)	-	1	1
12	2-5(3)	-	-	-	-
13	-	-	-	-	-
14	-	-	-	1	1

Seta No.	Abdominal Segments					Paddle
	V	VI	VII	VIII	XI	P
0	1,2(1)	1,2(1)	1	1	-	-
1	3,4(4)	2,3(2)	2	-	1	1
2	1	1	1	-	-	1
3	2	1,2(2)	2-4(2)	-	-	-
4	5,6(5)	2-4(3)	1,2(1)	2,3(2)	-	-
5	1,2(2)	2	1,2(2)	-	-	-
6	1,2(2)	1,2(2)	6-11(8)	-	-	-
7	5-7(6)	1	1	-	-	-
8	2-4(3)	2-4(3)	2-4(4)	-	-	-
9	1	1	3-5(4)	9-14(12)	-	-
10	1,2(1)	1,2(1)	1	-	-	-
11	1,2(1)	1,2(1)	2,3(2)	-	-	-
12	-	-	-	-	-	-
13	-	-	-	-	-	-
14	1	1	1	1	-	-

^a Based on specimens from the Yemen Arab Republic.
^b Range (mode).
^c With numerous secondary branches arising from 8-12(9) primary stems.
^d Alveolus only.

Table 16. Number of branches for pupal setae of *Culex poicilipes* (Theobald).^a

Seta No.	Cephalothorax	Abdominal Segments			
	CT	I	II	III	IV
0	-	-	1	1	1
1	3-5(4) ^b	- ^c	8-15(11)	7-14(9)	5-8(8)
2	3-5(4)	1-3(1)	1,2(1)	1	1
3	2-5(3)	2,3(2)	2,3(2)	2	5-11(6)
4	2-4(3)	8-17(14)	5-10(7)	6,7(6)	3-6(4)
5	4-6(6)	4-13(4)	7-14(8)	8-20(10)	3-5(3)
6	2-4(3)	1	1	3-5(3)	3-6(4)
7	2,3(2)	2,3(2)	1-3(2)	6-10(6)	4-8(7)
8	2-4(4)	-	-	5-8(5)	4-7(5)
9	2-4(2)	1,2(1)	1	1	1
10	7-16(9)	- ^d	-	2-4(3)	2,3(3)
11	2,3(2)	1,2(2)	-	1,2(2)	1,2(1)
12	3-6(4)	-	-	-	-
13	-	-	-	-	-
14	-	-	-	1	1

Seta No.	Abdominal Segments					Paddle
	V	VI	VII	VIII	XI	P
0	1	1	1	1- m ^e	-	-
1	5,6(5)	3,4(3)	2,3(3)	-	1	1
2	1,2(1)	1,2(1)	1,2(1)	-	-	1
3	2-5(3)	2,3(3)	3-5(4)	-	-	-
4	5-10(6)	3-7(5)	2-4(3)	2-4(3)	-	-
5	2	2	2-4(4)	-	-	-
6	3-6(4)	3-6(5)	6-17(8)	-	-	-
7	6-13(7)	1,2(1)	1	-	-	-
8	3-7(5)	3-5(4)	4-8(7)	-	-	-
9	1	1	2-5(3)	5-10(8)	-	-
10	1	1	1	-	-	-
11	1,2(2)	1-3(3)	2-4(3)	-	-	-
12	-	-	-	-	-	-
13	-	-	-	-	-	-
14	1	1	1	1-4(1)	-	-

^a Based on specimens from Egypt.
^b Range (mode).
^c With numerous secondary branches arising from 8-11(9) primary stems.
^d Alveolus only.
^e Many branches.

Table 17. Number of branches for pupal setae of *Culex mimeticus* Noè.^a

Seta No.	Cephalothorax	Abdominal Segments			
	CT	I	II	III	IV
0	-	-	1	1	1
1	2,3(2) ^b	- ^c	1-4(3)	3-6(4)	2-5(3)
2	2-4(3)	1	1	1	1
3	2-4(2)	2	1,2(2)	2	2-7(4)
4	1-3(2)	5-9(5)	3-6(4)	5-10(6)	2-4(2)
5	2,3(2)	2-7(3)	3-5(3)	2-5(3)	2-4(2)
6	2-4(2)	1	1	1,2(1)	1
7	2	1-3(2)	1-3(2)	5-9(6)	2-6(3)
8	2,3(2)	1	-	2,3(3)	1-4(3)
9	2-4(2)	-	1	1	1
10	4-6(5)	- ^d	2/1 ^e	1,2(2)	1,2(2)
11	2,3(2)	1	-	1	1
12	2-4(2)	-	-	-	-
13	-	-	-	-	-
14	-	-	-	1	1

Seta No.	Abdominal Segments					Paddle
	V	VI	VII	VIII	XI	P
0	1	1	1	1	-	-
1	1-3(2)	1,2(1)	1-3(2)	-	1	1
2	1	1	1	-	-	1
3	1,2(1)	1,2(2)	1-3(2)	-	-	-
4	2-5(4)	2-4(2)	1-3(1)	1,2(1)	-	-
5	2	2	1	-	-	-
6	1-3(1)	1,2(1)	3-7(3)	-	-	-
7	2-8(3)	1	1	-	-	-
8	1-3(2)	2,3(2)	2-4(2)	-	-	-
9	1	1	2-4(2)	4-9(6)	-	-
10	1	1	1	-	-	-
11	1	1	1,2(2)	-	-	-
12	-	-	-	-	-	-
13	-	-	-	-	-	-
14	1	1	1	1	-	-

^a Based on specimens from Israel.
^b Range (mode).
^c With numerous secondary branches arising from 5-8(6) primary stems.
^d Alveolus only.
^e Branches of setae on right/left sides of one specimen.

Table 18. Number of branches for pupal setae of *Culex bitaeniorhynchus* Giles.^a

Seta No.	Cephalothorax	Abdominal Segments			
	CT	I	II	III	IV
0	-	-	1	1	1
1	1-3(2) ^b	- ^c	1-4(2)	6-10(7)	2-6(4)
2	2-4(2)	1	1	1	1
3	1-4(2)	1	1	1	3-7(4)
4	1-3(2)	4-8(6)	2-6(4)	4-6(6)	2,3(3)
5	2,3(2)	3-9(3)	2-5(4)	3-6(5)	2,3(3)
6	1-4(2)	1,2(1)	1,2(1)	1	1
7	1,2(2)	1-3(2)	1,2(2)	3-6(5)	1-5(3)
8	1,2(2)	-	-	2-5(4)	2-4(3)
9	1,2(2)	1-3(2)	1	1	1,2(1)
10	5-10(7)	- ^d	-	2,3(2)	2
11	1,2(1)	1	-	1	1,2(1)
12	1-3(2)	-	-	-	-
13	-	-	-	-	-
14	-	-	-	1	1

Seta No.	Abdominal Segments					Paddle
	V	VI	VII	VIII	XI	P
0	1	1	1	1	-	-
1	2,3(2)	1,2(2)	1,2(2)	-	1	1
2	1	1	1	-	-	1
3	1-3(1)	1,2(1)	1,2(1)	-	-	-
4	2-5(4)	2,3(3)	1-3(2)	2	-	-
5	2,3(2)	2,3(2)	1,2(1)	-	-	-
6	1	1	3-8(5)	-	-	-
7	4-7(5)	1,2(1)	1	-	-	-
8	1-3(2)	2-4(3)	2-4(3)	-	-	-
9	1	1	3-5(3)	6-10(6)	-	-
10	1	1	1,2(1)	-	-	-
11	1	1,2(1)	1-3(2)	-	-	-
12	-	-	-	-	-	-
13	-	-	-	-	-	-
14	1	1	1	1	-	-

^a Based on specimens from Pakistan and the Yemen Arab Republic.
^b Range (mode).
^c With numerous secondary branches arising from 5-10(7) primary stems.
^d Alveolus only.

Table 19. Number of branches for pupal setae of *Culex tritaeniorhynchus* Giles.^a

Seta No.	Cephalothorax	Abdominal Segments			
	CT	I	II	III	IV
0	-	-	1	1	1
1	3,4(3) ^b	- ^c	20-36(28)	10-15(11)	7-12(10)
2	3-5(3)	1	1	1	1
3	2,3(3)	2	2	2	4-7(6)
4	1,2(2)	7-10(9)	4-7(5)	4-7(6)	1-4(3)
5	4-6(5)	4-7(6)	5-9(6)	6-8(8)	4-7(5)
6	3-6(4)	1	1	4-7(6)	3-6(5)
7	1,2(2)	2-5(4)	2-4(2)	4-8(5)	2-5(3)
8	6,7(7)	-	-	2-6(5)	3,4(3)
9	2,3(2)	1-3(1)	1	1	1
10	6-12(9)	- ^d	-	1,2(2)	2
11	2	1	-	1,2(1)	1
12	3-5(4)	-	-	-	-
13	-	-	-	-	-
14	-	-	-	1	1

Seta No.	Abdominal Segments					Paddle
	V	VI	VII	VIII	XI	P
0	1	1	1	1	-	-
1	7-10(8)	7-9(7)	5,6(5)	-	1	1
2	1	1	1	-	-	1
3	2,3(2)	2,3(2)	4-6(5)	-	-	-
4	5-7(6)	4-6(5)	2,3(3)	3,4(3)	-	-
5	2	2	1,2(2)	-	-	-
6	6,7(6)	6-8(7)	9-13(12)	-	-	-
7	5,6(6)	1	1	-	-	-
8	2-5(4)	2-5(3)	4-6(4)	-	-	-
9	1	1	3-5(5)	4-8(5)	-	-
10	1	1	1	-	-	-
11	1,2(1)	1,2(1)	2-5(2)	-	-	-
12	-	-	-	-	-	-
13	-	-	-	-	-	-
14	1	1	1	1	-	-

^a Based on specimens from Pakistan.^b Range (mode).^c With numerous secondary branches arising from 6-9(7) primary stems.^d Alveolus only.

Table 20. Number of branches for pupal setae of *Culex pseudovishnui* Colless.^a

Seta No.	Cephalothorax	Abdominal Segments			
	CT	I	II	III	IV
0	-	-	1	1	1
1	2-4(3) ^b	- ^c	9-15(12)	10-16(10)	7-10(9)
2	3-5(4)	1	1,2(1)	1	1
3	3	2,3(2)	2,3(2)	2	2-9(4)
4	1-3(2)	6-12(6)	4-8(7)	3-8(6)	2-4(4)
5	3-5(4)	3-7(4)	6-8(7)	5-9(6)	5-7(6)
6	2-5(3)	1	1	3-5(4)	4-6(5)
7	2	2-4(2)	2	3-9(7)	3-6(5)
8	3-5(5)	-	-	3-6(4)	3-5(4)
9	2,3(2)	2	1	1	1
10	3-10(9)	- ^d	-	2	2
11	2	1,2(1)	-	1	1
12	2-5(3)	-	-	-	-
13	-	-	-	-	-
14	-	-	-	1	1

Seta No.	Abdominal Segments					Paddle
	V	VI	VII	VIII	XI	P
0	1	1	1	1	-	-
1	4-8(7)	5-8(6)	3-5(4)	-	1	1,2(1)
2	1	1	1	-	-	1
3	2,3(2)	2,3(2)	3-5(4)	-	-	-
4	5-7(5)	4,5(4)	2,3(2)	2-4(2)	-	-
5	2-4(2)	2,3(2)	1,2(2)	-	-	-
6	5,6(5)	5-7(5)	5-11(8)	-	-	-
7	5-8(7)	1,2(1)	1	-	-	-
8	3-5(4)	4,5(4)	2-5(3)	-	-	-
9	1	1	3-6(4)	6-9(8)	-	-
10	1	1	1	-	-	-
11	1,2(1)	1-3(1)	2-4(3)	-	-	-
12	-	-	-	-	-	-
13	-	-	-	-	-	-
14	1	1	1	1	-	-

^a Based on specimens from Pakistan and India.

^b Range (mode).

^c With numerous secondary branches arising from 7-12(11) primary stems.

^d Alveolus only.

Table 21. Number of branches for fourth-instar larval setae of *Culex pipiens* Linnaeus.^a

Seta No.	Head	Thorax			Abdominal Segments		
	C	P	M	T	I	II	III
0	1	9-26(17) ^b	-	-	-	1	1
1	1	1	1	2-5(3)	1-5(5)	1-4(2)	1-4(2)
2	0-1(0)	1	2-5(3)	1-3(2)	1	1	1
3	1	1	1	2-5(4)	1,2(1)	1,2(1)	1,2(1)
4	1	2,3(2)	1,2(2)	2-5(4)	7-12(8)	3-7(4)	1-4(2)
5	4-7(5)	1	1	1	2-7(5)	1-3(2)	1-4(2)
6	3-6(4)	1	1	1	3,4(3)	2-4(3)	2,3(2)
7	8-13(10)	2,3(2)	1	6-10(10)	1-3(2)	3-6(4)	4-9(6)
8	2-4(2)	2,3(2)	5-9(5)	8-18(14)	-	1	1
9	3-7(5)	1	4-8(5)	4-9(6)	1-5(2)	1	1
10	2,3(2)	1	1	1	1-3(1)	1	1
11	2,3(2)	3-8(5)	1-4(2)	1-3(2)	3-10(4)	2-5(3)	1-3(2)
12	2,3(2)	1	1	1	1-3(2)	1-3(2)	1-3(1)
13	2-4(3)	-	14-27(23)	3-6(5)	1-3(2)	7-23(15)	2-5(3)
14	1,2(1)	1,2(1)	15-26(20)	-	-	-	1
15	3-5(3)	-	-	-	-	-	-

Seta No.	Abdominal Segments					
	IV	V	VI	VII	VIII	X
0	1	1	1	1	1	-
1	2-4(2)	1-3(2)	2,3(2)	2-5(3)	4-9(5)	1-3(1)
2	1	1	1,2(1)	1	1	2,3(2)
3	1,2(1)	1	1	1,2(1)	6-9(8)	1
4	1,2(1)	2-5(3)	1-3(2)	1	1	5-10(6)
5	1-3(2)	1-4(2)	1-4(3)	1-4(2)	3-5(4)	-
6	2	2	2	10-20(10)	-	-
7	5-10(7)	4-8(6)	1,2(1)	1	1a-S, ^c 1b-S, 1c-S, 1d-S,	2-6(3)
8	1	1,2(1)	2-5(3)	2-6(4)		2-6(3)
9	1	1	1	2-8(3)		1-4(2)
10	1	1	1	1		2-4(3)
11	1-4(3)	1-4(3)	2-4(3)	2-4(2)	-	-
12	1,2(1)	1	1	1	-	-
13	2-4(3)	2-4(3)	22-43(28)	2-4(3)	-	-
14	1	1	1	1	1	-
15	-	-	-	-	-	-

^a Based primarily on specimens from Egypt and Israel.
^b Range (mode) obtained from counts made on at least 40 setae.
^c Siphon occasionally with a fifth seta 1-S on one or both sides.

Table 22. Number of branches for fourth-instar larval setae of *Culex quinquefasciatus* Say.^a

Seta No.	Head		Thorax		Abdominal Segments		
	C	P	M	T	I	II	III
0	1	11-20(15) ^b	-	-	-	1	1
1	1	1	1,2(1)	2-5(2)	2-6(2)	1-4(2)	1
2	1	1	1,2(1)	1,2(1)	1	1	1
3	1	1	1,2(2)	2-4(3)	1,2(1)	1	1
4	1	2	1-3(2)	3-6(5)	6-10(8)	2-5(4)	1-4(1)
5	4-7(5)	1	1	1	5-10(6)	1-3(2)	1,2(2)
6	3-5(5)	1	1	1	3,4(3)	3,4(3)	2
7	7-10(8)	2	1	6-8(7)	2	2-5(4)	4-7(6)
8	2-4(3)	2	4-6(5)	9-16(11)	-	1	1
9	2-7(4)	1	4-6(5)	4-7(5)	1,2(2)	1	1
10	1-3(3)	1	1	1	1	1	1
11	2-4(3)	4-7(5)	2-4(2)	1-3(3)	3-7(6)	2-4(3)	1-3(2)
12	1-4(2)	1	1	1	1-3(2)	1,2(2)	1
13	2-5(4)	-	16-36(22)	3-7(6)	1,2(1)	10-25(17)	2-4(3)
14	1,2(1)	1	15-33(19)	-	-	-	1
15	2-4(3)	-	-	-	-	-	-

Seta No.	Abdominal Segments					
	IV	V	VI	VII	VIII	X
0	1	1	1	1	1	-
1	1,2(1)	1,2(2)	2	3-5(3)	4-8(6)	1
2	1	1	1	1	1	2,3(2)
3	1,2(1)	1	1	1,2(1)	5-9(7)	1
4	1,2(1)	2-4(3)	1,2(2)	1	1	3-10(6)
5	1,2(2)	1-3(2)	2-6(3)	2-5(4)	3-6(5)	-
6	2	2	2	8-15(12)	-	-
7	5-10(6)	5-7(6)	1	1	1a-S, ^c	4-12(8)
8	1,2(1)	1,2(1)	2-5(3)	2-5(4)	1b-S,	3-10(7)
9	1	1	1	3-6(4)	1c-S,	2-7(3)
10	1	1	1	1	1d-S,	2-7(3)
11	2,3(2)	2-4(2)	2-4(2)	2,3(2)	-	-
12	1,2(1)	1	1	1	-	-
13	1-4(3)	2-4(3)	22-46(31)	2-4(3)	-	-
14	1	1	1	1	1	-
15	-	-	-	-	-	-

^a Based on specimens from the Yemen Arab Republic and India.
^b Range (mode) obtained from counts made on at least 10 setae.
^c Siphon infrequently with only 3 pairs of setae; rarely with an additional unpaired seta.

Table 23. Number of branches for fourth-instar larval setae of *Culex vagans* Wiedemann.^a

Seta No.	Head	Thorax			Abdominal Segments		
	C	P	M	T	I	II	III
0	1	9-13(12) ^b	-	-	-	1	1
1	1	1	1	2-5(3)	3-10(6)	2-4(3)	1-3(2)
2	-	1	1-3(2)	1,2(1)	1,2(1)	1	1
3	1	1	1	2-6(4)	1,2(1)	1	1
4	1,2(1)	2	1-3(2)	3-6(4)	8-12(9)	3,4(4)	1-3(2)
5	5-8(6)	1	1	1	4-7(6)	1-3(2)	1-3(2)
6	4-8(5)	1	1	1	2-4(3)	3-5(4)	2,3(2)
7	7-12(8)	2-4(2)	1	6-9(6)	2,3(2)	3-6(4)	4-8(5)
8	2-4(3)	2,3(2)	4-8(6)	11-17(11)	-	1	1
9	3-7(7)	1	4-7(5)	4-8(6)	1-3(2)	1	1
10	2-4(2)	1	1	1	1	1	1
11	2-4(2)	4-7(5)	2,3(2)	2,3(2)	4-9(6)	2,3(2)	1-3(2)
12	2,3(3)	1	1	1	1-3(1)	1,2(2)	1,2(1)
13	2,3(3)	-	10-31(24)	3-7(4)	1-3(2)	10-25(18)	2-6(4)
14	1,2(1)	1,2(1)	15-30(24)	-	-	-	1
15	3-5(3)	-	-	-	-	-	-

Seta No.	Abdominal Segments					
	IV	V	VI	VII	VIII	X
0	1	1	1	1	1	-
1	2	2	1,2(1)	3-5(3)	5,6(5)	1,2(1)
2	1	1	1	1	1	1-3(2)
3	1	1	1	1	6-9(7)	1
4	1	2-4(2)	1,2(2)	1	1	4-7(5)
5	1-4(3)	2-5(3)	2-4(3)	2-4(3)	4,5(4)	-
6	2	2	2,3(2)	10-16(10)	-	-
7	4-9(6)	5-7(5)	1,2(1)	1,2(1)	1a-S, ^c	2-5(4)
8	1	1,2(1)	1-4(3)	3-6(6)	1b-S,	2-6(4)
9	1	1	1,2(1)	3-6(5)	1c-S,	1-4(2)
10	1	1	1	1	1d-S,	2-4(3)
11	1-3(2)	2,3(2)	2-4(2)	1,3(2)	-	-
12	1,2(1)	1	1	1	-	-
13	3-5(3)	3-5(3)	27-36(29)	3-5(4)	-	-
14	1	1	1	1	1	-
15	-	-	-	-	-	-

^a Based on specimens from Pakistan.
^b Range (mode) obtained from counts made on at least 10 setae.
^c Siphon occasionally with an additional unpaired seta.

Table 24. Number of branches for fourth-instar larval setae of *Culex torrentium* Martini.^a

Seta No.	Head		Thorax		Abdominal Segments		
	C	P	M	T	I	II	III
0	1	9-13(11) ^b	-	-	-	1	1
1	1	1	2-4(3)	3-7(4)	2-6(5)	1-3(2)	4,5(4)
2	-	1	1-4(2)	2	1	1	1
3	1	1	1	3,4(4)	1-3(2)	1,2(1)	1,2(1)
4	1,2(1)	2	2,3(2)	2-4(3)	7-12(9)	3-5(4)	1
5	4-7(5)	1	1	1	4-7(5)	1-4(1)	1-3(1)
6	3-5(4)	1	1,2(1)	1	3,4(3)	3-5(4)	2
7	8-10(8)	2,3(2)	1	4-8(6)	2,3(2)	3-5(4)	3-7(4)
8	2-4(2)	2	3-7(5)	8-15(12)	-	1	1
9	2-5(3)	1	4-6(6)	5-7(6)	1-3(2)	1	1,2(1)
10	2,3(2)	1	1	1	1	1	1
11	2-4(3)	4-8(6)	1-3(2)	1,2(2)	4-6(4)	2-4(3)	2,3(2)
12	2,3(3)	1	1	1	1,2(2)	2,3(2)	1,2(1)
13	2,3(3)	-	13-20(18)	3-8(5)	1,2(1)	12-19(17)	4-6(4)
14	1-3(1)	1	12-25(19)	-	-	-	1
15	3,4(4)	-	-	-	-	-	-

Seta No.	Abdominal Segments					
	IV	V	VI	VII	VIII	X
0	1	1	1	1	1	-
1	3-6(4)	3-5(4)	2-5(3)	4-6(4)	5-9(6)	1,2(2)
2	1	1	1	1	1	2,3(2)
3	1,2(1)	1	1	2	6-9(7)	1
4	1	3-5(3)	1,2(2)	1,2(1)	1	3-8(6)
5	1-4(2)	1-4(2)	2-5(3)	1-4(3)	3-5(4)	-
6	2	2	2	8-13(10)	-	-
7	4-7(6)	4-7(5)	1	1	1a-S, ^c	2,3(3)
8	1	1,2(1)	2-4(2)	3-8(6)	1b-S,	1-3(3)
9	1,2(1)	1,2(1)	1,2(1)	2-6(3)	1c-S,	2
10	1	1	1	1	1d-S,	1-3(2)
11	1,2(2)	2	1-3(2)	1,2(1)	-	-
12	1	1	1	1	-	-
13	4-6(4)	3-5(4)	17-34(28)	3,4(3)	-	-
14	1	1	1	1	1	-
15	-	-	-	-	-	-

^a Based on specimens from Sweden.
^b Range (mode) obtained from counts made on at least 10 setae.
^c Siphon often with a fifth seta 1-S on one or both sides; seldom with 3 on one side.

Table 25. Number of branches for fourth-instar larval setae of *Culex decens* Theobald.^a

Seta No.	Head		Thorax		Abdominal Segments		
	C	P	M	T	I	II	III
0	1	13-19(15) ^b	-	-	-	1	1
1	1	1	1,2(1)	1,2(1)	1-3(1)	1	1-3(2)
2	-	1	2-4(3)	1,2(2)	1,2(1)	1,2(1)	1
3	1	1	1	3-5(3)	2	1,2(2)	1,2(1)
4	1	2,3(2)	1,2(2)	4-7(6)	6-11(9)	4-6(5)	1,2(1)
5	2,3(2)	1	1	1,2(1)	7-9(8)	2,3(2)	1-4(2)
6	2	1	1	1	3	3	1
7	5-7(6)	3	1	5-7(6)	2	4-7(5)	4-7(5)
8	4-6(5)	2	4,5(4)	10-18(11)	-	1,2(2)	1,2(2)
9	4-8(7)	1	3,4(4)	5,6(6)	3,4(4)	1	1
10	1-3(2)	1	1	1	1	1	1
11	1,2(2)	5-7(6)	2-4(3)	2-4(3)	4-8(5)	2-5(3)	2,3(2)
12	2-4(3)	1	1	1,2(1)	1,2(2)	2-4(3)	1,2(1)
13	3-5(4)	-	18-28(24)	5-7(6)	1-3(2)	14-23(17)	2-5(4)
14	1-3(2)	1	16-24(21)	-	-	-	1
15	3-6(4)	-	-	-	-	-	-

Seta No.	Abdominal Segments					
	IV	V	VI	VII	VIII	X
0	1	1	1	1	1	-
1	1	1	2,3(3)	2-5(4)	5-7(6)	1,2(2)
2	1	1	1	1	1	2
3	2	1	1	2,3(2)	5-7(7)	1
4	1	4-6(5)	2,3(3)	1	1	3-9(7)
5	2-4(2)	2,3(2)	2-4(3)	2-4(2)	3,4(3)	-
6	1-3(2)	1	1	11-21(15)	-	-
7	5-7(6)	4-8(6)	1	1	1a-S, ^c	1-3(2)
8	2	2	2-4(4)	2-4(2)	1b-S,	2,3(2)
9	1	1	1	1,2(2)	1c-S,	2,3(2)
10	1	1	1	1	1d-S,	1-3(2)
11	2,3(2)	2,3(2)	2,3(3)	2-4(3)	-	-
12	1	1	1	1	-	-
13	3-6(4)	3-5(4)	32-56(42)	2-4(3)	-	-
14	1	1	1	1	1	-
15	-	-	-	-	-	-

^a Based on specimens from the Yemen Arab Republic (primarily) and Senegal.

^b Range (mode) obtained from counts made on at least 10 setae.

^c Siphon occasionally with a fifth paired or unpaired seta.

Table 26. Number of branches for fourth-instar larval setae of *Culex antennatus* (Becker).^a

Seta No.	Head		Thorax		Abdominal Segments		
	C	P	M	T	I	II	III
0	1	17-29(23) ^b	-	-	-	1	1
1	1	1	1-3(2)	2-4(2)	1-4(4)	1-3(2)	3,4(4)
2	-	1	4-8(5)	2,3(2)	1	1	1
3	1	1	1	4-7(5)	2-5(3)	2-4(3)	2,3(2)
4	1,2(1)	2	1-3(2)	3-8(4)	8-14(11)	5-9(6)	2-4(2)
5	2,3(2)	1	1	1,2(1)	4-9(5)	2,3(3)	2-5(3)
6	2,3(2)	1	1	1	3	3,4(3)	1-3(2)
7	6-8(8)	3	1	5-8(7)	2	5-9(6)	7-10(9)
8	3-5(5)	2	4,5(5)	9-16(12)	-	1,2(1)	1,2(1)
9	4-7(5)	1	4,5(4)	4-6(5)	3,4(3)	1	1
10	3,4(3)	1,2(1)	1	1	1	1	1
11	2,3(2)	6-9(6)	2-4(2)	2-5(3)	4-6(5)	2-4(3)	2,3(2)
12	3-5(4)	1	1	1-3(2)	1-4(2)	2,3(2)	1,2(2)
13	2-4(3)	-	26-43(36)	7-14(8)	2,3(2)	15-30(20)	4-7(5)
14	1,2(1)	1	14-27(21)	-	-	-	1
15	5-8(7)	-	-	-	-	-	-

Seta No.	Abdominal Segments					
	IV	V	VI	VII	VIII	X
0	1	1	1	1	1	-
1	3,4(3)	2-4(3)	2,3(3)	3-6(5)	6-8(8)	3,4(4)
2	1	1	1	1	1	2,3(2)
3	2-4(3)	1,2(1)	1	3-5(4)	7-9(7)	1
4	1-3(2)	5-8(6)	3,4(3)	1	1	5-11(8)
5	2,3(2)	1-3(2)	2,3(2)	2,3(2)	4,5(4)	-
6	3	2,3(2)	1	12-20(15)	-	-
7	6-12(9)	8-13(9)	2,3(3)	1,2(1)	1a-S, ^c	3-5(4)
8	1,2(2)	2	1-4(2)	4-7(5)	1b-S,	4-6(4)
9	1	1	1	2-4(2)	1c-S,	3-6(5)
10	1	1	1	1	1d-S,	3-5(4)
11	2,3(2)	1,2(2)	2,3(3)	2-4(3)	1e-S,	2-4(4)
12	2	1	1	1	1f-S,	2-5(3)
13	3-6(5)	4-6(5)	31-47(39)	3-6(4)	-	-
14	1	1	1	1	1	-
15	-	-	-	-	-	-

^a Based on specimens from Egypt.
^b Range (mode) obtained from counts made on at least 10 setae.
^c Seta 1-S often only in 5 pairs. Seta 1a-S often absent; sometimes single.

Table 27. Number of branches for fourth-instar larval setae of *Culex univittatus* Theobald.^a

Seta No.	Head	Thorax			Abdominal Segments		
	C	P	M	T	I	II	III
0	1	8-26(19) ^b	-	-	-	1	1
1	1	1	1,2(1)	1-3(2)	2-5(3)	1-3(2)	2-4(3)
2	0,1(0)	1	2-7(2)	2-4(3)	1,2(1)	1	1
3	1	1	1	2-6(5)	2-4(2)	1-3(2)	1-3(2)
4	1	2	1-4(3)	2-7(4)	5-15(12)	3-7(5)	1-4(3)
5	2-4(3)	1	1	1-3(1)	4-12(5)	1-3(3)	1-4(2)
6	2,3(3)	1	1	1	3,4(3)	3	2,3(2)
7	6-8(6)	2,3(3)	1	5-7(6)	2,3(2)	2-7(5)	4-9(8)
8	2-6(5)	2,3(2)	5,6(5)	7-16(10)	-	1,2(1)	1,2(2)
9	3-9(7)	1	3-6(4)	5,6(5)	2-4(2)	1,2(1)	1
10	2-4(3)	1,2(1)	1	1	1	1	1,2(2)
11	2,3(2)	6-10(7)	1-4(2)	2-5(3)	2-7(4)	3,4(3)	1-3(2)
12	2-5(4)	1	1	1-5(2)	1-3(2)	1-3(2)	1-3(2)
13	3-5(4)	-	20-41(29)	5-10(7)	1-3(2)	9-22(20)	3,4(4)
14	1,2(2)	1	10-28(21)	-	-	-	1
15	3-8(6)	-	-	-	-	-	-

Seta No.	Abdominal Segments					
	IV	V	VI	VII	VIII	X
0	1	1	1	1	1	-
1	2-4(3)	2-4(3)	2-4(3)	3-7(5)	4-9(6)	2-4(3)
2	1	1	1	1	1	2,3(2)
3	2-4(3)	1,2(2)	1-3(2)	3-6(4)	4-9(7)	1
4	1,2(1)	3-9(6)	1-5(4)	1	1	3-10(7)
5	1-3(2)	1-3(2)	1-4(3)	1-5(4)	2-5(5)	-
6	2,3(2)	2	1,2(1)	7-23(16)	-	-
7	3-11(8)	5-12(8)	1-3(3)	1	1a-S, ^c	2-6(6)
8	1-3(2)	2,3(2)	2-4(4)	3-7(3)	1b-S,	2-6(6)
9	1	1	1	2-5(4)	1c-S,	1-6(4)
10	1,2(2)	1	1	1	1d-S,	1-5(4)
11	1-3(2)	1-3(2)	2,3(2)	2-4(3)	1e-S,	1-4(3)
12	1,2(1)	1	1	1	1f-S,	1-3(3)
13	3-5(4)	3-5(4)	16-42(30)	3-6(4)	-	-
14	1	1	1	1	1	-
15	-	-	-	-	-	-

^a Based on specimens from Zimbabwe (type locality) and South Africa.

^b Range (mode) obtained from counts made on at least 10 setae.

^c Seta 1a-S usually borne below last pecten spine when present.

Table 28. Number of branches for fourth-instar larval setae of *Culex perexiguus* Theobald.^a

Seta No.	Head		Thorax		Abdominal Segments		
	C	P	M	T	I	II	III
0	1	10-23(19) ^b	-	-	-	1	1
1	1	1	1,2(1)	2,3(2)	2-4(2)	1,2(2)	3,4(3)
2	-	1	3-5(4)	2,3(2)	1	1	1
3	1	1	1,2(1)	3-5(4)	2-4(2)	1,2(1)	1,2(2)
4	1	2	1-3(2)	4-6(4)	6-14(8)	4-8(5)	1-3(2)
5	2,3(3)	1	1	1	4-9(5)	3,4(3)	2,3(3)
6	2,3(2)	1	1	1	2,3(3)	3	2
7	4-8(6)	3,4(3)	1	5-8(8)	1,2(2)	3-6(5)	5-8(6)
8	3-5(4)	2	3-6(6)	6-18(9)	-	1,2(1)	1,2(2)
9	5-9(5)	1	3-5(3)	4-6(5)	2-4(3)	1	1
10	2-4(3)	1	1,2(1)	1	1	1	1,2(2)
11	1-3(2)	4-8(5)	1-4(2)	2-4(2)	3-6(4)	2,3(2)	1,2(2)
12	2-5(3)	1	1	1-3(1)	2	2,3(3)	1-3(2)
13	2-4(2)	-	21-42(29)	5-8(6)	2,3(2)	11-26(15)	3-5(3)
14	2	1	15-28(21)	-	-	-	1
15	3-7(6)	-	-	-	-	-	-

Seta No.	Abdominal Segments					
	IV	V	VI	VII	VIII	X
0	1	1	1	1	1	-
1	2-4(3)	2-4(3)	3,4(3)	3-5(4)	5-8(6)	2,3(2)
2	1	1	1	1	1	2
3	1-3(2)	1,2(1)	1,2(2)	2-4(3)	5-8(8)	1
4	1	4-6(6)	2-4(3)	1	1	4-9(7)
5	2,3(2)	2,3(2)	2,3(2)	2-4(3)	3-5(4)	-
6	2,3(2)	2	1,2(1)	9-18(11)	-	-
7	4-8(7)	5-10(5)	1,2(2)	1	1a-S, ^c	3
8	1-3(2)	2	2-4(3)	4-6(4)	1b-S,	2,3(3)
9	1	1	1	1-3(2)	1c-S,	2,3(2)
10	1,2(1)	1	1	1	1d-S,	2,3(2)
11	1,2(1)	2	1-3(2)	2,3(2)	1e-S,	1,2(2)
12	1,2(1)	1	1	1	-	-
13	3-5(4)	3-5(4)	26-44(29)	2-5(3)	-	-
14	1	1	1	1	1	-
15	-	-	-	-	-	-

^a Based on specimens from Egypt.
^b Range (mode) obtained from counts made on at least 10 setae.
^c Siphon sometimes with only 4 setae on one side.

Table 29. Number of branches for fourth-instar larval setae of *Culex theileri* Theobald.^a

Seta No.	Head		Thorax		Abdominal Segments		
	C	P	M	T	I	II	III
0	1	13-25(16) ^b	-	-	-	1	1
1	1	1	1-4(1)	2-4(2)	4-6(4)	2-6(3)	4,5(4)
2	-	1	3-9(3)	1-3(2)	1	1	1
3	1	1	1	3-8(5)	2-5(3)	1-3(2)	1,2(2)
4	1-3(2)	2	2,3(2)	3-6(4)	10-18(14)	4-7(6)	1-4(3)
5	3,4(3)	1	1	1	3-11(5)	3-8(4)	3-6(5)
6	2,3(2)	1	1	1	3	3,4(3)	3
7	6-10(7)	3,4(3)	1	5-7(6)	2	4-9(7)	9-20(9)
8	3-7(5)	2,3(2)	4-6(5)	12-19(15)	-	1,2(2)	2,3(2)
9	5-9(6)	1	4-6(5)	4-6(5)	1-5(3)	1	1
10	3,4(3)	1,2(1)	1	1	1	1	1,2(1)
11	1,2(2)	5-9(5)	3-5(3)	2-6(3)	3-6(5)	2-7(3)	2,3(2)
12	3-6(4)	1	1	1,2(2)	1-3(3)	2,3(2)	1-3(2)
13	1-3(3)	-	30-48(32)	6-10(7)	2-5(2)	21-35(29)	3-5(5)
14	1,2(2)	1	21-39(34)	-	-	-	1
15	5-9(6)	-	-	-	-	-	-

Seta No.	Abdominal Segments					
	IV	V	VI	VII	VIII	X
0	1	1	1	1	1	-
1	3-5(4)	3,4(3)	2-4(3)	3-5(4)	5-9(7)	2-4(3)
2	1	1	1	1	1	3-5(4)
3	2-4(2)	1-3(1)	1	3-8(5)	7-10(8)	1
4	1,2(1)	3-9(7)	2-5(4)	1	1,2(1)	6-12(8)
5	2-5(3)	1-5(3)	3-5(4)	4-6(4)	4,5(4)	-
6	3	2,3(3)	3	14-22(18)	-	-
7	8-14(8)	7-14(9)	1	1	1a-S, ^c	7-10(9)
8	2,3(2)	2,3(2)	3-6(3)	5-9(5)	1b-S,	7-11(9)
9	1	1	1	2-7(4)	1c-S,	6-10(8)
10	1,2(1)	1,2(1)	1	1	1d-S,	2-6(5)
11	2-4(2)	2-4(3)	3,4(3)	2-4(3)	1e-S,	4-7(6)
12	1,2(1)	1	1	1	-	-
13	3-5(4)	3-5(4)	38-52(46)	2-6(3)	-	-
14	1	1	1	1	1	-
15	-	-	-	-	-	-

^a Based on specimens from Egypt, Israel, and the Yemen Arab Republic.
^b Range (mode) obtained from counts made on at least 10 setae.
^c Siphon usually with 10 seta 1-S, not distinctly paired; sometimes with as few as 7 or as many as 13.

Table 30. Number of branches for fourth-instar larval setae of *Culex laticinctus* Edwards.^a

Seta No.	Head		Thorax		Abdominal Segments		
	C	P	M	T	I	II	III
0	1	11-19(14) ^b	-	-	-	1	1
1	1	1	1-4(3)	1-3(2)	1-3(2)	1,2(1)	1,2(1)
2	0,1	1	1-5(3)	2,3(2)	1	1	1
3	1	1	1	3-5(4)	2-7(3)	1-3(2)	1-3(2)
4	1	2	1,2(2)	3-6(5)	12-15(12)	3-8(5)	1,2(1)
5	4-6(5)	1	1,2(1)	1	4-6(4)	3-8(4)	3-6(5)
6	3,4(4)	1	1	1	3,4(3)	3,4(3)	1,2(1)
7	7-11(8)	3,4(3)	1	6-8(6)	2	2-5(4)	5-10(7)
8	3-6(5)	2	4-7(5)	8-18(13)	-	1,2(1)	1,2(1)
9	4,5(4)	1	4-6(5)	4-8(5)	2-4(2)	1	1
10	2-5(3)	1,2(1)	1	1	1	1	1
11	1,2(2)	2-6(4)	3-5(3)	2-4(4)	5-7(5)	2,3(2)	1-3(2)
12	2-4(3)	1	1	2,3(2)	1-3(1)	2,3(3)	1
13	2,3(2)	-	20-30(24)	7-11(10)	1	13-29(22)	3-6(4)
14	2,3(2)	1	16-21(20)	-	-	-	1
15	3-5(4)	-	-	-	-	-	-

Seta No.	Abdominal Segments					
	IV	V	VI	VII	VIII	X
0	1	1	1	1	1	-
1	1	1	1,2(1)	2,3(2)	6-8(7)	1,2(2)
2	1	1	1	1	1	4,5(4)
3	1,2(2)	1	1	2-4(2)	8-12(10)	1
4	1	4-6(4)	1,2(2)	1	1	6-13(10)
5	1,2(1)	1,2(1)	1,2(1)	1,2(2)	4-6(6)	-
6	1,2(1)	1	1	10-15(10)	-	-
7	6-10(9)	5-8(7)	1	1	1a-S, ^c	6-11(10)
8	1,2(1)	1,2(2)	1-3(2)	4-6(4)	1b-S,	7-11(10)
9	1	1	1	1-4(2)	1c-S,	7-11(10)
10	1	1	1	1	1d-S,	7-13(10)
11	1-3(2)	1-3(2)	1-3(2)	1-3(1)	1e-S,	5-12(7)
12	1	1	1	1	1f-S,	2-4(3)
13	3-6(4)	2-6(4)	25-39(31)	3-6(4)	1g-S,	1-4(3)
14	1	1	1	1	1	-
15	-	-	-	-	-	-

^a Based on specimens from Israel and the Yemen Arab Republic.
^b Range (mode) obtained from counts made on at least 10 setae.
^c Seta 1-S usually with 14 (12-15) imperfectly paired setae.

Table 31. Number of branches for fourth-instar larval setae of *Culex mattinglyi* Knight.^a

Seta No.	Head	Thorax			Abdominal Segments		
	C	P	M	T	I	II	III
0	1	7-12(9) ^b	-	-	-	1	1
1	1	1	1	1,2(1)	2-6(5)	1-3(2)	1,2(2)
2	1	1	2-4(4)	2-4(3)	1	1	1
3	1	1,2(2)	1	3-6(4)	2,3(3)	1,2(2)	1,2(1)
4	1	2	1,2(2)	3-5(3)	6-10(7)	3-6(5)	1
5	3-5(4)	1	1	1	3-5(3)	1,2(1)	1,2(1)
6	3,4(3)	1	1	1	2-5(2)	2-4(3)	2-5(3)
7	7-10(8)	2-4(2)	1	5-9(8)	2,3(2)	3-5(4)	5-9(7)
8	2-4(3)	2-4(2)	6,7(7)	9-14(12)	-	1	1
9	4-7(4)	1	5-8(6)	6-10(8)	1,2(1)	1,2(1)	1
10	2-5(3)	1	1	1	1	1	1
11	2-4(3)	2-4(3)	2-4(3)	2,3(3)	2-7(3)	1-4(2)	1,2(1)
12	2-4(3)	1	1	1	1,2(1)	2,3(2)	1
13	2,3(2)	-	12-22(17)	4-7(5)	1,2(1)	9-14(13)	2-6(4)
14	1	1	16-27(21)	-	-	-	1
15	2-5(4)	-	-	-	-	-	-

Seta No.	Abdominal Segments					
	IV	V	VI	VII	VIII	X
0	1	1	1	1	1	-
1	1,2(1)	1,2(1)	1,2(1)	2	5-8(6)	2,3(3)
2	1	1	1	1	1	2,3(2)
3	1,2(1)	1	1	1,2(2)	12-14(12)	1
4	1	3-5(4)	2,3(2)	1	1	7-12(9)
5	1-4(2)	1-4(2)	1-3(2)	1-3(2)	3,4(4)	-
6	2-5(2)	2,3(2)	2,3(2)	6-9(8)	-	-
7	5-8(7)	6-8(7)	1,2(1)	1,2(1)	1a-S, ^c	5-10(8)
8	1	1	1-4(2)	2-4(3)	1b-S,	7-13(9)
9	1	1	1	1-4(3)	1c-S,	7-12(10)
10	1	1	1	1	1d-S,	7-11(10)
11	1-3(2)	1-3(2)	1-4(2)	1-3(1)	1e-S,	7-12(10)
12	1,2(1)	1	1	1	1f-S,	2-5(3)
13	4,5(5)	3-5(4)	16-29(21)	2-5(2)	1g-S,	3-7(6)
14	1	1	1	1	1	-
15	-	-	-	-	-	-

^a Based on specimens from the Yemen Arab Republic.
^b Range (mode) obtained from counts made on at least 10 setae.
^c Siphon normally with 14 seta 1-S (7 pairs), but 11-16 may be present.

Table 32. Number of branches for fourth-instar larval setae of *Culex simpsoni* Theobald.^a

Seta No.	Head		Thorax		Abdominal Segments		
	C	P	M	T	I	II	III
0	1	13-19(16) ^b	-	-	-	1	1
1	1	1	1,2(1)	1,2(1)	1-6(3)	1	4,5(4)
2	-	1	2-4(3)	1-3(2)	1,2(1)	1	1
3	1	1	1	3,4(3)	2,3(2)	2	2
4	1	3,4(4)	2	2-5(3)	9-13(10)	3-8(4)	1-3(2)
5	1,2(1)	1	1	1	2-6(4)	1-3(2)	1-4(1)
6	1,2(2)	1	1	1	3	3	3,4(3)
7	7-10(9)	3,4(3)	1	6-8(6)	1,2(2)	4-6(5)	8-13(8)
8	3-5(4)	2,3(2)	4-6(6)	8-19(11)	-	1,2(1)	2,3(2)
9	4-8(6)	1	3-5(5)	4-8(5)	2,3(3)	1	1
10	2,3(3)	1	1	1	1	1	1,2(1)
11	2	3-5(4)	1-3(2)	1-3(2)	3-6(4)	2-4(3)	2
12	4-7(5)	1	1	1,2(1)	1,2(1)	2	2
13	3,4(3)	-	23-38(30)	5-7(5)	2	15-24(19)	3-5(4)
14	2-4(2)	1,2(2)	11-24(20)	-	-	-	1
15	4-6(5)	-	-	-	-	-	-

Seta No.	Abdominal Segments					
	IV	V	VI	VII	VIII	X
0	1	1	1	1	1	-
1	4,5(4)	4,5(5)	3,4(4)	4-7(5)	5-7(5)	2,3(3)
2	1	1	1,2(1)	1	1	2-4(2)
3	2	1	1	2-5(3)	6-10(7)	1
4	1,2(1)	3-7(5)	1-3(2)	1	1	4-11(10)
5	1,2(1)	1-3(1)	1-3(2)	1-3(2)	3,4(4)	-
6	3-5(3)	2-4(3)	3,4(3)	14-25(19)	-	-
7	6-10(9)	7-10(8)	1	1	1a-S, 1b-S, 1c-S, 1d-S,	2,3(3)
8	2	2	3	3-8(5)		2-4(2)
9	1	1	1	1-3(1)		2,3(2)
10	1,2(1)	1	1	1		1,2(2)
11	2,3(2)	2,3(2)	2,3(2)	1-3(2)	-	-
12	1,2(1)	1	1	1	-	-
13	3-6(4)	3-5(4)	29-45(33)	3-6(4)	-	-
14	1	1	1	1	1	-
15	-	-	-	-	-	-

^a Based on specimens from Ethiopia, Kenya, and Tanzania.
^b Range (mode) obtained from counts made on at least 10 setae.

Table 33. Number of branches for fourth-instar larval setae of *Culex sinaiticus* Kirkpatrick.^a

Seta No.	Head	Thorax			Abdominal Segments		
	C	P	M	T	I	II	III
0	1	13-22(18) ^b	-	-	-	1	1
1	1	1	1,2(1)	1	2-4(3)	1	3-5(3)
2	-	1	2-5(3)	2	1,2(1)	1	1
3	1	1	1	3-5(3)	2,3(2)	1,2(2)	1,2(2)
4	1	1-4(3)	1-3(2)	3-5(4)	8-11(10)	3-6(5)	2,3(2)
5	1	1	1	1	2-6(3)	1-3(2)	1-3(2)
6	1,2(2)	1	1	1	2,3(3)	3	3
7	6-8(7)	3	1	5-7(5)	1,2(2)	4-6(4)	6-10(9)
8	3-7(4)	1,2(2)	4-6(5)	7-12(8)	-	1	2
9	3-6(3)	1	3,4(4)	4-6(5)	2-4(2)	1	1
10	2-4(2)	1	1	1	1	1	1,2(1)
11	1,2(2)	2-6(4)	1-3(3)	1-3(2)	2-6(3)	2,3(2)	2
12	3-6(4)	1	1	1,2(1)	1,2(2)	2,3(2)	2
13	3,4(4)	-	19-28(23)	5-8(5)	2,3(2)	14-22(17)	3,4(3)
14	2-4(2)	1,2(2)	10-23(15)	-	-	-	1
15	4-6(5)	-	-	-	-	-	-

Seta No.	Abdominal Segments					
	IV	V	VI	VII	VIII	X
0	1	1	1	1	1	-
1	4,5(4)	4,5(5)	2-5(4)	4-7(5)	5,6(5)	2,3(3)
2	1	1	1	1,2(1)	1	2,3(3)
3	2	1,2(1)	1	3,4(3)	7,8(8)	1
4	1,2(1)	4-6(5)	2,3(2)	1	1	4-9(6)
5	1,2(2)	1-3(2)	1-4(2)	2,3(2)	3,4(3)	-
6	3	3	3	12-20(17)	-	-
7	7-11(9)	6-9(7)	1	1	1a-S,	2-4(3)
8	2,3(2)	2,3(2)	3-5(3)	4-7(4)	1b-S,	1-3(3)
9	1	1	1	1,2(1)	1c-S,	2,3(2)
10	1,2(1)	1	1	1	1d-S,	2,3(2)
11	2,3(2)	2	2,3(2)	2,3(2)	-	-
12	1,2(2)	1,2(1)	1	1	-	-
13	3,4(3)	3,4(4)	22-43(35)	4,5(4)	-	-
14	1	1	1	1	1	-
15	-	-	-	-	-	-

^a Based on specimens from Israel, Egypt (Sinai), and Iran.
^b Range (mode) obtained from counts made on at least 10 setae.

Table 34. Number of branches for fourth-instar larval setae of *Culex duttoni* Theobald.^a

Seta No.	Head		Thorax		Abdominal Segments		
	C	P	M	T	I	II	III
0	1	18-25(20) ^b	-	-	-	1	1
1	1	1	1	1-3(2)	1-5(2)	1,2(1)	1
2	-	1	1-4(3)	1	1	1	1
3	1	1,2(1)	1	4-6(6)	1	1	1
4	1	2,3(2)	2	2-7(4)	10-13(11)	5-10(7)	2,3(2)
5	6-8(7)	1,2(1)	1	1	5-14(7)	1-4(4)	2-5(4)
6	7-9(8)	1	1	1	2,3(2)	2-4(2)	1
7	7-11(9)	2	1	5-11(8)	2-5(3)	3,4(3)	6,7(6)
8	1,2(2)	3-6(4)	5-10(5)	16-24(20)	-	1	1
9	1-6(4)	1	4-7(5)	5-9(6)	1-5(3)	1	1
10	2,3(2)	1	1	1	1	1	1
11	2,3(2)	2-7(6)	2-4(2)	1-3(2)	2-15(9)	2,3(2)	1-3(2)
12	3-5(3)	1	1	1	1,2(1)	1	1
13	2-5(3)	-	18-37(28)	3-6(5)	1-4(2)	15-34(25)	2,3(2)
14	1,2(1)	1	21-37(27)	-	-	-	1
15	3-5(3)	-	-	-	-	-	-

Seta No.	Abdominal Segments					
	IV	V	VI	VII	VIII	X
0	1	1	1	1	1	-
1	1	1	1	1	4-9(6)	1
2	1	1	1	1	1	1
3	1	1	1	1,2(1)	7-11(9)	1
4	2,3(2)	1-7(5)	2-5(2)	1	1	4-7(5)
5	2-7(3)	2-6(2)	3-9(5)	2-6(4)	3-6(5)	-
6	1	1	1	12-27(20)	-	-
7	8-16(9)	7-12(9)	1	1	1a-S, ^c 1b-S, 1c-S, 1d-S, 1e-S,	1
8	1	1,2(1)	3-7(4)	7-15(10)		1
9	1	1,2(1)	1	2-5(3)		1
10	1	1	1	1		1,2(1)
11	2-4(2)	2-4(3)	2-5(3)	1-4(3)		1-4(3)
12	1,2(1)	1	1	1	-	-
13	2	1,2(2)	21-52(37)	2-5(4)	-	-
14	1	1	1	1	1	-
15	-	-	-	-	-	-

^a Based on unassociated specimens from P.D.R. Yemen, Ethiopia, Cameroon, Ghana, and Uganda.

^b Range (mode) obtained from counts made on 12 setae (in most cases).

^c Five pairs of seta 1-S were observed in specimens from P.D.R. Yemen. Only four pairs were present in specimens from other areas.

Table 35. Number of branches for fourth-instar larval setae of *Culex sitiens* Wiedemann.^a

Seta No.	Head		Thorax		Abdominal Segments		
	C	P	M	T	I	II	III
0	1	9-16(12) ^b	-	-	-	1	1
1	1	1	1	1	1-3(1)	1	2,3(2)
2	-	1	2-4(3)	1,2(1)	1	1	1
3	1	1	1	2-4(3)	1,2(1)	1	1
4	1	2	1,2(2)	3-6(4)	5-14(9)	2-6(4)	1,2(2)
5	6-8(7)	1	1,2(1)	1	2-7(4)	2-4(3)	2-4(3)
6	4-7(4)	1	1	1	3,4(3)	2-4(3)	2
7	7-11(9)	2,3(3)	1	6-9(7)	1,2(1)	4-6(5)	5-9(6)
8	3-5(4)	1,2(2)	4-6(6)	8-15(14)	-	1	1-3(1)
9	3,4(3)	1	4-6(5)	4-7(5)	1,2(2)	1	1
10	2-4(2)	1	1	1	1	1	1
11	2-4(2)	4-8(6)	2-4(3)	2-5(3)	1-3(2)	1,2(2)	2
12	2,3(3)	1	1	1,2(1)	1,2(1)	1,2(2)	1,2(2)
13	1-3(2)	-	13-21(16)	2-5(3)	1-3(2)	10-21(12)	2
14	1	1	13-25(18)	-	-	-	1
15	2,3(3)	-	-	-	-	-	-

Seta No.	Abdominal Segments					
	IV	V	VI	VII	VIII	X
0	1	1	1	1	1	-
1	2,3(2)	2,3(2)	2,3(2)	2,3(3)	5-8(6)	1
2	1	1	1	1	1	3-5(4)
3	1	1	1	1-4(2)	8-11(9)	1,2(1)
4	1,2(1)	2-6(4)	1-3(2)	1,2(1)	1	6-12(10)
5	2,3(2)	2,3(2)	2-4(2)	2-5(3)	4	-
6	2	2	1,2(2)	6-13(11)	-	-
7	5-8(6)	5-8(6)	1,2(1)	1	1a-S, ^c	6-9(6)
8	2	2	2-4(2)	3-6(4)	1b-S,	6-8(6)
9	1	1	1	2,3(2)	1c-S,	6-9(7)
10	1	1	1	1	1d-S,	5-7(6)
11	2,3(2)	2	2,3(2)	1-3(2)	1e-S,	2-5(3)
12	1-3(2)	1	1	1	1f-S,	4-7(5)
13	1-3(2)	2-4(2)	14-36(28)	2,3(2)	1g-S,	1-4(3)
14	1	1	1	1	1	-
15	-	-	-	-	-	-

^a Based on specimens from the Yemen Arab Republic, United Arab Emirates, and Oman.
^b Range (mode) obtained from counts made on at least 10 setae.
^c Seta 1a-S may be absent on one or both sides of the siphon.

Table 36. Number of branches for fourth-instar larval setae of *Culex poicilipes* (Theobald).^a

Seta No.	Head		Thorax		Abdominal Segments		
	C	P	M	T	I	II	III
0	1	15-30(22) ^b	-	-	-	1	1
1	1	1	5-8(5)	3-6(5)	7-10(9)	5-9(6)	6-8(7)
2	-	1	4-10(5)	3-5(4)	3-5(3)	2-4(3)	1-3(2)
3	1	1	1,2(2)	6-11(9)	2-7(5)	2-4(3)	3-5(3)
4	1-3(2)	2	4-6(4)	5-10(6)	11-19(15)	7-10(8)	3-5(4)
5	3-5(4)	1	1	2-4(3)	5-10(7)	5-16(12)	7-13(11)
6	4-6(4)	1	1	1,2(2)	3	3,4(3)	3,4(3)
7	10-15(10)	3,4(3)	1	5-8(6)	1,2(2)	8-18(11)	9-27(17)
8	3-7(5)	2	4-8(6)	8-17(12)	-	1,2(1)	2,3(2)
9	6-12(8)	1-3(2)	4-6(4)	4-7(5)	3-6(5)	1,2(1)	1
10	3-5(4)	1,2(1)	1	1	1-3(2)	1	2,3(2)
11	2,3(2)	4-8(8)	2-4(4)	2-4(2)	6-10(7)	5-9(6)	4-6(4)
12	3-7(5)	1	1	2,3(2)	2-4(3)	2-4(4)	2-5(3)
13	2	-	24-45(32)	12-23(21)	2-5(4)	18-40(29)	5-9(6)
14	1,2(1)	1	31-43(37)	-	-	-	1
15	5,6(5)	-	-	-	-	-	-

Seta No.	Abdominal Segments					
	IV	V	VI	VII	VIII	X
0	1	1	1	1	1	-
1	6-10(9)	7-9(8)	6-9(7)	5-10(7)	5-8(7)	2-5(4)
2	1-3(2)	1-3(1)	1-3(2)	1,2(1)	2,3(2)	3-7(5)
3	3,4(4)	2,3(2)	2,3(2)	7-10(8)	7-11(8)	1
4	2-5(4)	6-12(9)	2-6(4)	1-3(3)	1	7-14(11)
5	6-10(8)	4-8(5)	3-7(5)	2-8(5)	5-7(4)	-
6	3,4(3)	3	3,4(3)	13-27(19)	-	-
7	10-16(13)	10-16(10)	2-6(3)	3,4(3)	1a-S,	4-7(5)
8	3,4(3)	3-5(3)	3-7(4)	5-12(7)	1b-S,	5-8(5)
9	1,2(1)	1	1	2-5(3)	1c-S,	3-5(4)
10	1,2(2)	1,2(1)	2,3(2)	4-6(5)	1d-S,	5,6(6)
11	3-6(5)	3-7(4)	3-6(4)	2-6(4)	1e-S,	5-8(5)
12	2-4(3)	1-3(1)	1	1	-	-
13	5-7(6)	5-7(6)	43-57(50)	6-10(6)	-	-
14	1	1	1	1	1	-
15	-	-	-	-	-	-

^a Based on specimens from Egypt.
^b Range (mode) obtained from counts made on at least 10 setae.

Table 37. Number of branches for fourth-instar larval setae of *Culex mimeticus* Noè.^a

Seta No.	Head	Thorax			Abdominal Segments		
	C	P	M	T	I	II	III
0	1	8-16(11) ^b	-	-	-	1	1
1	1	1	1	1,2(1)	1,2(1)	1	1
2	-	1	2-7(4)	1,2(1)	1	1	1
3	1	1	1	3-5(3)	1,2(1)	1,2(1)	1
4	2-4(3)	1	2,3(2)	3-6(4)	6-12(11)	3-7(4)	2-4(3)
5	3,4(4)	1	1	1-3(1)	2-6(3)	1-4(2)	1-3(1)
6	2,3(2)	1	1	1	3,4(3)	3,4(3)	3
7	5-8(6)	2,3(3)	1	5-8(8)	1,2(1)	2-5(4)	5,6(6)
8	2-4(3)	2,3(2)	5,6(5)	9-16(11)	-	1	1
9	3-6(4)	1	3-5(5)	5,6(5)	2,3(2)	1,2(1)	1
10	2-4(3)	1	1	1	1	1	1
11	2-4(3)	4-10(5)	3,4(3)	2-4(3)	2-4(2)	2,3(2)	2
12	2,3(3)	1	1	1,2(1)	1-3(2)	1,2(2)	1,2(2)
13	2,3(2)	-	20-34(25)	1-3(2)	2-4(2)	13-23(15)	1,2(2)
14	1	1	15-28(19)	-	-	-	1
15	2,3(3)	-	-	-	-	-	-

Seta No.	Abdominal Segments					
	IV	V	VI	VII	VIII	X
0	1	1	1	1	1	-
1	1,2(2)	2,3(2)	2,3(2)	3,4(4)	5-8(6)	1-3(2)
2	1	1	1	1	1,2(1)	2,3(2)
3	1,2(1)	1	1,2(1)	2-4(2)	6-8(7)	1
4	2,3(2)	4-6(4)	2,3(2)	1	1	3-6(4)
5	1-3(1)	1-3(1)	1,2(1)	2-5(2)	3,4(4)	-
6	3,4(3)	2,3(3)	2,3(2)	10-17(14)	-	-
7	5-9(6)	5-7(6)	1	1	1a-S, ^c	3-6(4)
8	1,2(1)	2	1,2(2)	2-5(3)	1b-S,	3-7(4)
9	1	1	1	2-4(3)	1c-S,	3-7(4)
10	1	1	1	1	1d-S,	3-6(4)
11	2,3(2)	1-3(2)	2,3(2)	2,3(2)	1e-S,	2-4(2)
12	1,2(2)	1	1	1	1f-S,	1-3(2)
13	1,2(1)	1,2(1)	25-41(34)	1-3(1)	-	-
14	1	1	1	1	1	-
15	-	-	-	-	-	-

^a Based on specimens from Israel and Iran.
^b Range (mode) obtained from counts made on at least 10 setae.
^c Siphon most often with 12 seta 1-S (6 pairs), but 10-14 may be present.

Table 38. Number of branches for fourth-instar larval setae of *Culex bitaeniorhynchus* Giles.^a

Seta No.	Head		Thorax		Abdominal Segments		
	C	P	M	T	I	II	III
0	1	10-20(14) ^b	-	-	-	1	1
1	1	1	1,2(1)	1	1-4(2)	1,2(1)	2,3(2)
2	-	1	3-7(4)	1-3(2)	1,2(1)	1	1,2(1)
3	1	1	1	3,4(3)	1-3(2)	2,3(3)	2,3(2)
4	1-4(2)	1,2(2)	2,3(2)	2-6(5)	8-11(8)	3-8(8)	1-3(2)
5	2,3(3)	1	1	1,2(1)	4-8(8)	2-4(3)	2-4(3)
6	2	1	1	1	3,4(3)	2,3(3)	3,4(3)
7	4-7(6)	3	1	6-9(7)	1	3-7(5)	5-10(6)
8	2-4(2)	2,3(2)	4-6(5)	8-23(16)	-	1	1,2(1)
9	4,5(4)	1-3(2)	5-8(6)	5-7(5)	2,3(3)	1	1
10	2,3(2)	1-3(1)	1	1	1,2(2)	1,2(1)	2
11	1,2(1)	3-7(5)	2-4(2)	2-6(4)	2-4(3)	2-4(2)	2,3(2)
12	2-5(3)	1	1	1,2(1)	1,2(2)	2	2
13	1-3(1)	-	23-45(35)	3-6(4)	2,3(2)	13-18(15)	2,3(2)
14	1	1	16-34(20)	-	-	-	1
15	2,3(3)	-	-	-	-	-	-

Seta No.	Abdominal Segments					
	IV	V	VI	VII	VIII	X
0	1	1	1	1	1	-
1	2,3(2)	2,3(3)	1-3(2)	2,3(2)	5-7(5)	2-4(3)
2	1	1	1-3(1)	1	2,3(2)	2-5(3)
3	2-4(3)	1-3(2)	2-5(3)	2-4(2)	5-7(6)	1
4	1,2(2)	4-7(6)	2-5(3)	2,3(2)	2	4-9(6)
5	2,3(2)	2,3(2)	2,3(2)	2-4(3)	3-5(3)	-
6	2-5(3)	2-5(3)	2,3(2)	10-19(11)	-	-
7	4-10(6)	4-9(7)	2,3(2)	1-3(2)	1a-S,	2,3(2)
8	2	2	1-3(3)	2-5(5)	1b-S,	2-4(2)
9	1	1	1	1-3(1)	1c-S,	2,3(2)
10	1,2(2)	1,2(2)	1,2(2)	2-6(3)	1d-S,	1-3(2)
11	1,2(2)	2	2,3(2)	1,2(1)	-	-
12	2	1	1,2(2)	2,3(2)	-	-
13	2,3(2)	2,3(2)	23-35(25)	2-4(2)	-	-
14	1	1	1	1	1	-
15	-	-	-	-	-	-

^a Based on specimens from Iran, Pakistan, and the Yemen Arab Republic.
^b Range (mode) obtained from counts made on at least 10 setae.

Table 39. Number of branches for fourth-instar larval setae of *Culex tritaeniorhynchus* Giles.^a

Seta No.	Head		Thorax		Abdominal Segments		
	C	P	M	T	I	II	III
0	1	17-23(19) ^b	-	-	-	1	1
1	1	1	1,2(1)	1,2(1)	2-4(3)	1,2(2)	2-4(3)
2	-	1	4-8(5)	2,3(2)	1,2(1)	1	1
3	1	1	1	5-8(5)	2-4(3)	2-4(3)	2,3(2)
4	1	1,2(2)	2,3(3)	3-6(4)	11-16(13)	6-10(8)	1-3(2)
5	3,4(3)	1	1	1	4-8(5)	2-4(2)	2,3(2)
6	2,3(2)	1	1	1	2,3(3)	2,3(3)	2,3(2)
7	5-10(8)	2,3(3)	1	5-7(6)	1-3(2)	5-8(7)	6-12(9)
8	3-8(6)	2	3-5(5)	9-18(11)	-	1	1,2(1)
9	3-7(3)	1	3-5(4)	4,5(5)	2-4(2)	1	1
10	2-4(3)	1	1	1	1	1	1
11	2	5-9(6)	2-5(3)	1-4(3)	3,4(3)	2-4(3)	1,2(2)
12	2-4(3)	1	1	1-3(2)	1-3(2)	2,3(2)	2
13	2-4(3)	-	20-35(28)	7-11(9)	2,3(2)	11-23(17)	2-5(5)
14	1	1,2(1)	21-30(25)	-	-	-	1
15	3-5(4)	-	-	-	-	-	-

Seta No.	Abdominal Segments					
	IV	V	VI	VII	VIII	X
0	1	1	1	1	1	-
1	4	4	3-6(4)	4-7(5)	4-7(5)	2-4(3)
2	1	1	1	1	1,2(1)	2-4(3)
3	2,3(3)	1,2(1)	1	4-6(5)	7,8(7)	1
4	1-3(2)	5-9(6)	2-4(3)	1,2(2)	1,2(1)	6-11(8)
5	2,3(2)	2,3(3)	2-4(3)	3-6(3)	5,6(5)	-
6	2,3(2)	2,3(2)	2	10-17(17)	-	-
7	6-11(9)	6-10(10)	2-4(3)	2,3(2)	1a-S, ^c	3-6(4)
8	2,3(2)	2,3(2)	3-5(4)	4-13(7)	1b-S,	3-5(4)
9	1	1	1	2-4(3)	1c-S,	2-5(4)
10	1	1	1	1,2(2)	1d-S,	2-4(3)
11	2,3(2)	2-4(2)	2,3(2)	2-4(3)	1e-S,	2-4(3)
12	1,2(2)	1	1	1	1f-S,	2-4(3)
13	4-6(4)	2-5(5)	21-48(38)	2-6(5)	-	-
14	1	1	1	1	1,2(1)	-
15	-	-	-	-	-	-

^a Based on specimens from Iran, Pakistan, and Saudi Arabia.
^b Range (mode) obtained from counts made on at least 10 setae.
^c Siphon with 10-13 seta 1-S; usually with 12 (6 pairs).

Table 40. Number of branches for fourth-instar larval setae of *Culex pseudovishnui* Colless.^a

Seta No.	Head		Thorax		Abdominal Segments		
	C	P	M	T	I	II	III
0	1	11-24(15) ^b	-	-	-	1	1
1	1	1	1,2(1)	1,2(1)	1-3(2)	1,2(2)	4-8(5)
2	-	1	3-5(4)	2,3(2)	1,2(1)	1	1
3	1	1	1	4-7(5)	3-7(3)	2-4(2)	2-4(2)
4	1-3(1)	1-3(2)	2,3(3)	2-5(3)	8-14(11)	4-10(7)	2,3(2)
5	2-4(3)	1	1	1,2(1)	3-5(4)	2,3(2)	2,3(2)
6	1-3(2)	1	1	1	3	3	3,4(3)
7	8-12(9)	3	1	4-6(5)	1	4-9(6)	7-12(8)
8	2-6(4)	1,2(2)	3-5(4)	11-20(14)	-	1	1,2(1)
9	5-10(5)	1	3-5(4)	3-6(4)	2-4(3)	1	1
10	3,4(3)	1	1	1	1	1	1
11	1-3(2)	4-6(4)	3,4(4)	2,3(3)	3-5(4)	2,3(3)	2,3(2)
12	2-5(2)	1	1	1-3(2)	1,2(2)	1-3(2)	2,3(2)
13	1-3(2)	-	35-44(40)	7-12(9)	2,3(2)	13-32(21)	3-6(4)
14	1	1	14-32(15)	-	-	-	1
15	2-5(3)	-	-	-	-	-	-

Seta No.	Abdominal Segments					
	IV	V	VI	VII	VIII	X
0	1	1	1	1	1	-
1	4-7(6)	4-9(7)	4-8(6)	6-9(8)	4,5(5)	3,4(3)
2	1	1	1	1	1	2,3(3)
3	2,3(2)	1,2(1)	1	3-7(4)	5-8(7)	1
4	1-3(2)	4-7(6)	2-4(3)	1	1	4-10(8)
5	2-4(2)	2,3(2)	2-4(2)	2-5(3)	5-7(5)	-
6	2-4(3)	3,4(3)	2,3(3)	12-23(16)	-	-
7	6-12(8)	7-13(8)	3,4(3)	1-3(2)	1a-S, ^c	4,5(4)
8	2-4(2)	2,3(2)	3-5(3)	4-11(5)	1b-S,	3-5(4)
9	1	1	1	1-5(2)	1c-S,	3-5(4)
10	1	1	1	1	1d-S,	2-4(3)
11	2,3(2)	2-4(2)	2-5(2)	2-4(3)	1e-S,	3-5(4)
12	2,3(2)	1	1	1	1f-S,	3-5(3)
13	4,5(5)	4-7(5)	29-55(42)	5-7(5)	-	-
14	1	1	1	1	1	-
15	-	-	-	-	-	-

^a Based on specimens from Pakistan.
^b Range (mode) obtained from counts made on at least 10 setae.
^c Siphon with 13-15 seta 1-S; usually with 14 (7 pairs).

Table 41. Comparison of potentially diagnostic characters observed in members of the *Culex univittatus* species aggregate.

Character	<i>univittatus</i>	<i>perexiguus</i>	<i>neavei</i>
1) Ventral surface of proboscis	pale in middle	pale except at base, weakly pale on distal 0.25	inconspicuously pale in middle
2) Postspiracular area	tendency for scales to cover less than dorsal 0.5	tendency for scales to cover more than dorsal 0.5	tendency for scales to occur in small patch near spiracle
3) Forefemur	sometimes with indistinct anterior pale stripe	usually with indistinct anterior pale stripe	no anterior pale stripe
4) Midfemur	with complete distinct or indistinct anterior pale stripe	with or without incomplete faint or distinct anterior pale stripe	normally without anterior pale stripe, weakly indicated when present
5) Hindtibia	with distinct anterior and posterior pale stripes on proximal 0.8, separated ventrally by complete dark stripe; with distinct apical pale spot	with distinct anterior and posterior pale stripes on proximal 0.8, partly separated on proximal 0.5 or less by weak ventral dark stripe; with distinct apical pale spot	with rather indistinct anterior and posterior pale stripes ending before base; with rather indistinct apical pale spot
6) Wing – Costa	with short line of pale scales at base	with short line of pale scales at base	without pale scales at base
– Vein 2A	female usually with line of scales	female occasionally with few scales	female occasionally with few scales
7) Abdomen – Pale bands of terga	normal	normal	reduced or absent
8) Male genitalia – Seta <i>g</i>	narrow	broad	broad
– Ventral arm	long	short	long

APPENDIX A

Species of Culicidae other than *Culex* (*Culex*) known to occur in
southwestern Asia and Egypt

(subspecies and varieties not recognized)

1. *Anopheles* (*Anopheles*) *algeriensis* Theobald, 1903a
2. *Anopheles* (*Anopheles*) *claviger* (Meigen, 1804)
3. *Anopheles* (*Anopheles*) *coustani* Laveran, 1900
4. *Anopheles* (*Anopheles*) *habibi* Mulligan and Puri, 1936
5. *Anopheles* (*Anopheles*) *hyrcanus* (Pallas, 1771)
6. *Anopheles* (*Anopheles*) *maculipennis* Meigen, 1818
7. *Anopheles* (*Anopheles*) *marteri* Senevet and Prunelle, 1927
8. *Anopheles* (*Anopheles*) *melanoon* Hackett, 1934
9. *Anopheles* (*Anopheles*) *plumbeus* Stephens, 1828
10. *Anopheles* (*Anopheles*) *sacharovi* Favre, 1903
11. *Anopheles* (*Anopheles*) *tenebrosus* Dönitz, 1902
12. *Anopheles* (*Cellia*) *apoci* Marsh, 1933
13. *Anopheles* (*Cellia*) *arabiensis* Patton, 1905
14. *Anopheles* (*Cellia*) *azaniae* Bailly-Choumara, 1960
15. *Anopheles* (*Cellia*) *cinereus* Theobald, 1901a
16. *Anopheles* (*Cellia*) *culicifacies* Giles, 1901c
17. *Anopheles* (*Cellia*) *demeilloni* Evans, 1933
18. *Anopheles* (*Cellia*) *dthali* Patton, 1905
19. *Anopheles* (*Cellia*) *fluviatilis* James, 1902
20. *Anopheles* (*Cellia*) *hispaniola* (Theobald, 1903a)
21. *Anopheles* (*Cellia*) *moghulensis* Christophers, 1924
22. *Anopheles* (*Cellia*) *multicolor* Cambouliu, 1902
23. *Anopheles* (*Cellia*) *pharoensis* Theobald, 1901a
24. *Anopheles* (*Cellia*) *pretoriensis* (Theobald, 1903a)
25. *Anopheles* (*Cellia*) *pulcherrimus* Theobald, 1902
26. *Anopheles* (*Cellia*) *rhodesiensis* Theobald, 1901a
27. *Anopheles* (*Cellia*) *sergentii* (Theobald, 1907)
28. *Anopheles* (*Cellia*) *splendidus* Koidzumi, 1920
29. *Anopheles* (*Cellia*) *squamosus* Theobald, 1901a
30. *Anopheles* (*Cellia*) *stephensi* Liston, 1901
31. *Anopheles* (*Cellia*) *subpictus* Grassi, 1899
32. *Anopheles* (*Cellia*) *superpictus* Grassi, 1899
33. *Anopheles* (*Cellia*) *turkhudi* Liston, 1901
34. *Aedes* (*Aedimorphus*) *hirsutus* (Theobald, 1901a)
35. *Aedes* (*Aedimorphus*) *natronius* Edwards, 1932b
36. *Aedes* (*Aedimorphus*) *vexans* (Meigen, 1830)
37. *Aedes* (*Aedimorphus*) *vittatus* (Bigot, 1861)
38. *Aedes* (*Finlaya*) *echinus* (Edwards, 1920)
39. *Aedes* (*Finlaya*) *geniculatus* (Olivier, 1791)
40. *Aedes* (*Ochlerotatus*) *berlandi* Séguy, 1921
41. *Aedes* (*Ochlerotatus*) *caballus* (Theobald, 1912)
42. *Aedes* (*Ochlerotatus*) *caspicus* (Pallas, 1771)

43. *Aedes (Ochlerotatus) chelli* (Edwards, 1915)
44. *Aedes (Ochlerotatus) detritus* (Haliday, 1833)
45. *Aedes (Ochlerotatus) duplex* Martini, 1926
46. *Aedes (Ochlerotatus) flavescens* (Müller, 1764)
47. *Aedes (Ochlerotatus) lepidonotus* Edwards, 1920
48. *Aedes (Ochlerotatus) leucomelas* (Meigen, 1804)
49. *Aedes (Ochlerotatus) nigrocanus* Martini, 1927
50. *Aedes (Ochlerotatus) phoeniciae* Coluzzi and Sabatini, 1968
51. *Aedes (Ochlerotatus) pulchritarsis* (Rondani, 1872)
52. *Aedes (Ochlerotatus) rusticus* (Rossi, 1790)
53. *Aedes (Rusticoidus) refiki* Medschid, 1928
54. *Aedes (Stegomyia) aegypti* (Linnaeus, 1762)
55. *Aedes (Stegomyia) cretinus* Edwards, 1921
56. *Culex (Barraudius) modestus* Ficalbi, 1889(1890)
57. *Culex (Barraudius) pusillus* Macquart, 1850
58. *Culex (Culiciomyia) nebulosus* Theobald, 1901c
59. *Culex (Lasiosiphon) adairi* Kirkpatrick, 1926
60. *Culex (Lutzia) tigripes* De Grandpre and De Charmoy, 1900(1901)
61. *Culex (Maillotia) arbieeni* Salem, 1938
62. *Culex (Maillotia) deserticola* Kirkpatrick, 1924(1925)
63. *Culex (Maillotia) hortensis* Ficalbi, 1889a
64. *Culex (Maillotia) quettensis* Mattingly, 1955b
65. *Culex (Maillotia) salisburyensis* Theobald, 1901a
66. *Culex (Neoculex) impudicus* Ficalbi, 1890
67. *Culex (Neoculex) judaicus* Edwards, 1926
68. *Culex (Neoculex) martinii* Medschid, 1930
69. *Culex (Neoculex) territans* Walker, 1856
70. *Culiseta (Allotheobaldia) longiareolata* (Macquart, 1838a)
71. *Culiseta (Culicella) morsitans* (Theobald, 1901a)
72. *Culiseta (Culicella) setivalva* (Monchadskii, 1936)
73. *Culiseta (Culiseta) annulata* (Schränk, 1776)
74. *Culiseta (Culiseta) subochrea* (Edwards, 1921 [in Wesenberg-Lund, 1921])
75. *Coquillettidia (Coquillettidia) buxtoni* (Edwards, 1923)
76. *Coquillettidia (Coquillettidia) richiardii* (Ficalbi, 1889b)
77. *Orthopodomyia pulcripalpis* (Rondani, 1872)
78. *Uranotaenia (Pseudoficalbia) unguiculata* Edwards, 1913a

APPENDIX B

Complete synonymy of *Culex (Culex) pipiens* Linnaeus

- pipiens** Linnaeus, 1758: 602. Type locality: Sweden, Scania, Veberöd, Silvåkra farm. +Neotype male (NMNH), designated by Harbach et al., 1985: 9.
- bifurcatus** Linnaeus, 1758: 603. Type locality: France. Lectotype male (non-extant, illustrated by Réaumur, 1738: Pl. 40, Fig. 2), designated by Harbach et al., 1985: 7. Synonymy with *pipiens* by Martini, 1922: 107.
- fasciatus** Müller, 1764: 87. Type locality: none designated. Location of type(s) (adult) unknown. Synonymy with *pipiens* by Edwards, 1921: 345.
- molestus** Forskål, 1775: 85. Type locality: Egypt, Buhayrah Gov., Rosetta. +Neotype male (NMNH), designated by Harbach et al., 1984: 523. Synonymy with *pipiens* restored by Harbach et al., 1984: 540; prior synonymy with *pipiens* by Edwards, 1921: 345.
- trifurcatus** Fabricius, 1794: 401. Type locality: "Europae paludosis." Type(s) (adult) non-extant. Synonymy with *pipiens* by Edwards, 1932a: 210.
- luteus** Meigen, 1804: 6. Type locality: Europe. Type(s) (female) non-extant. Synonymy with *pipiens* by Edwards, 1932a: 310.
- domesticus** Germar, 1817: 290. Type locality: Yugoslavia, Dalmatia. Location of type(s) (adult) unknown. Synonymy with *molestus* by Marshall and Staley, 1937: 23; prior synonymy with *pipiens* by Edwards, 1921: 345.
- rufus** Meigen, 1818: 7. Type locality: none designated. +Syntypes (male; female) (MNHP), see Harbach, 1983: 103. Synonymy with *pipiens* by Edwards, 1921: 345.
- bicolor** Meigen, 1818: 9. Type locality: ? Africa. +Type female (MNHP), see Harbach 1983: 99. Synonymy with *pipiens* by Edwards, 1921: 345.
- marginalis** Stephens, 1825: 455. Type locality: England, London. Type(s) (female) (BM). Synonymy with *pipiens* by Edwards, 1921: 345.
- meridionalis** Leach, 1825: 292. Type locality: France, Nice. Location of type(s) (adult) unknown. Synonymy with *pipiens* by Edwards, 1921: 345.
- consobrinus** Robineau-Desvoidy, 1827: 408. Type locality: U.S.A., Pennsylvania. Type(s) (adult) non-extant. Synonymy with *pipiens* by Edwards, 1932a: 209.
- calcitrans** Robineau-Desvoidy, 1827: 409. Type locality: France, Paris; Germany. Type(s) (female) non-extant. Synonymy with *pipiens* by Edwards, 1921: 345.

- thoracicus** Robineau-Desvoidy, 1827: 409. Type locality: France, Paris. Type(s) (female) non-extant. Synonymy with *pipiens* by Edwards, 1921: 345.
- pallipes** Waltl, 1835: 110. Type locality: Spain. Type(s) (female) (MNHP). Synonymy with *pipiens* by Edwards, 1921: 345.
- unistriatus** Curtis, 1837: 231. Type locality: England. Type(s) (adult) (NMM). Synonymy with *pipiens* by Stone et al., 1959: 254.
- pallipes** Macquart, 1838a: 37. Type locality: Egypt. Type(s) (adult) non-extant. Synonymy with *pipiens* by Edwards, 1921: 345.
- rufinus** Bigot, 1888: 7. Type locality: Tunisia, El-Djerid. Type(s) (female) (non-extant). Synonymy with *pipiens* by Edwards, 1921: 345.
- agilis** Bigot 1889: 122. Type locality: Algeria. Type(s) (female) (BC). Synonymy with *pipiens* by Edwards, 1921: 345.
- phytophagus** Ficalbi, 1889 (1890): 126. Type locality: Italy, Sardinia, Romagna, Toscana. Location of types (male; female) unknown. Synonymy with *pipiens* by Edwards, 1921: 345.
- haematophagus** Ficalbi, 1893: 143. Type locality: Europa (e d'Italia). Location of type(s) (adult) unknown. Synonymy with *molestus* by Marshall and Staley, 1937: 23; prior synonymy with *pipiens* by ? Edwards, 1921: 345.
- melanorhinus** Giles, 1900: 342. *Nomen novum* for *pallipes* Macquart, 1838b: 37, *non* Waltl, 1835: 110.
- varioannulatus** Theobald, 1903a: 198. Type locality: Azores, St. Michaels. Type(s) (female) (BM). Synonymy with *pipiens* by Edwards, 1913b: 53.
- azoriensis** Theobald, 1903a: 210. Type locality: Azores, St. Michaels. Types (male; female) (BM). Synonymy with *pipiens* by Edwards, 1913b: 53.
- longefurcatus** Becker, 1903: 68. Type locality: Egypt, Cairo. Type(s) (female) (ZM). Synonymy with *pipiens* by Edwards, 1932a: 209.
- quasimodestus** Theobald, 1905b: 88 (*bicolor* var. ?). Type locality: Tunisia, Sfax. Type(s) (female) (HNM). Synonymy with *molestus* by Stone, 1957: 172; prior synonymy with *pipiens* by Edwards, 1921: 246.
- doliorum** Edwards, 1912a: 263 (*pipiens* var.). Type locality: England, Devon, Kingswear. Type(s) (male) (BM).
- autogenicus** Roubaud, 1935: 444 (*pipiens* ssp.). Type locality: France. Location of type(s) (egg) unknown (probably lost), see Harbach, 1983: 106. Synonymy with *molestus* by Marshall and Staley, 1937: 18.
- berbericus** Roubaud, 1935: 445 (*pipiens* ssp.). Type locality: North Africa [Algeria].

Location of type(s) (egg) unknown (probably lost), see Harbach 1983: 106.
Synonymy with *molestus* by Knight and Abdel-Malek, 1951: 184.

sternopallidus Roubaud, 1945: 54 (*autogenicus* ssp.). Type locality: France, Aigues-Mortes and Bages (Pyrenees-Orientales). Location of type(s) (adult) unknown (probably lost), see Harbach, 1983: 106.

sternopunctatus Roubaud, 1945: 54 (*autogenicus* ssp.). Type locality: France, Arles and Paris. Location of type(s) (adult) unknown (probably lost), see Harbach, 1983: 106.

disjunctus Roubaud, 1957: 3116 (*pipiens* ssp.). Type locality: France, Normandy, Ifs. Type(s) non-extant. Synonymy with *pipiens* by Stone et al., 1959: 254.

calloti Rioux and Pech, 1959: 117 (*pipiens* ssp.). NEW SYNONYMY. Type locality: France and Tunisia. Location of type(s) (adult) unknown.

erectus Iglisch, 1977: 269 (*pipiens* ssp.). NEW SYNONYMY. Type locality: West Germany, Berlin-Zehlendorf, Krummer Fenn. No type(s) designated.

torridus Iglisch, 1977: 269 (*pipiens* ssp.). NEW SYNONYMY. Type locality: West Germany, Berlin-Zehlendorf, Krummer Fenn. No type(s) designated.

APPENDIX C

Complete synonymy of *Culex* (*Culex*) *quinquefasciatus* Say

quinquefasciatus Say, 1823: 10. Type locality: New Orleans, Louisiana, USA.
+Neotype male (NMNH), designated by Sirivanakarn and White, 1978: 362.

pungens Wiedemann, 1828: 9. Type locality: New Orleans, Louisiana, USA.
Lectotype female (NMW), designated by Belkin, 1968b: 19. Synonymy with *quinquefasciatus* by Edwards, 1932a: 208.

fatigans Wiedemann, 1828: 10. Type locality: East Indies [Indonesia]. Lectotype female (NMW), designated by Belkin, 1968a: 68. Synonymy with *quinquefasciatus* by Dyar and Knab, 1909a: 34.

aestuans Wiedemann, 1828: 11. Type locality: Salvador, Bahia, Brazil. Lectotype male (NMW), designated by Stone, 1958: 186. Synonymy with *quinquefasciatus* by Stone, 1958: 186.

acer Walker, 1848: 8. Type locality: New Zealand. Holotype female (BM). Synonymy with *fatigans* by Edwards, 1924: 395.

cingulatus Doleschall, 1856: 405. Type locality: Ambarawa, Java. Location of type(s) (adult) unknown. Synonymy with *fatigans* by Edwards, 1932a: 208.

cubensis Bigot, 1857: 329. Type locality: Cuba. Lectotype female (MNHP), designated by Belkin, 1968b: 15. Synonymy with *fatigans* by Edwards, 1932a: 208.

anxifer Bigot, 1859: 117. Type locality: Madagascar. Location of types (male; female) unknown. Synonymy with *fatigans* by Edwards, 1932a: 208.

serotinus Philippi, 1865: 595. Type locality: Santiago and Valdivia, Chile. Types (male; female) non-extant. Synonymy with *fatigans* by Edwards, 1932a: 209.

autumnalis Weyenbergh, 1882: 23. Type locality: Primero River, Cordoba, Argentina. Location of type(s) (male; female; pupa; larva) uncertain (? Universidad de Cordoba). Synonymy with *fatigans* by Edwards, 1932a: 208.

penafieli Sanchez, 1885: 213. Type locality: Mexico City, Mexico. Location of types (male; female) unknown. Synonymy with *fatigans* by Edwards, 1932a: 208.

macleayi Skuse, 1889: 1746. King George's Sound, Western Australia, Australia. Type(s) (female) (MM). Synonymy with *fatigans* by Edwards, 1924: 395.

skusii Giles, 1900: 292. Type locality: Australia. Location of type(s) (male; female) unknown. Synonymy with *fatigans* by Edwards, 1924: 395.

- doleschallii** Giles, 1900: 338. *Nomen novum* for *cingulatus* Doleschall, 1856: 405. Synonymy with *fatigans* by Edwards, 1932a: 208.
- albolineatus** Giles, 1901a: 609. Type locality: Shahjahanpur, India. Lectotype female (BM), designated by Sirivanakarn, 1976: 33. Synonymy with *fatigans* by Barraud, 1924b: 1264.
- quasipipiens** Theobald, 1901b: 136. Type locality: Sambalpur, Central Provinces, India. Lectotype female (BM), designated by Bram, 1967b: 327. Synonymy with *fatigans* by Edwards, 1913b: 55.
- fouchowensis** Theobald, 1901b: 137. Type locality: Foochow, China. Lectotype male (BM), designated by Bram, 1967a: 196. Synonymy with *fatigans* by Edwards, 1913b: 55.
- reesi** Theobald, 1901b: 145. Type locality: Hong Kong. Type(s) non-extant (Bram, 1967a: 196). Synonymy with *fatigans* by Edwards, 1913b: 55.
- sericeus** Theobald, 1901b: 147. Type locality: Hong Kong. Location of type(s) (female) unknown. Synonymy with *fatigans* by Edwards, 1913b: 55.
- luteoannulatus** Theobald, 1901b: 159 (*fatigans* ssp.). Type locality: none designated. Type(s) (adult) (BM). Synonymy with *fatigans* by Edwards, 1932a: 208.
- trilineatus** Theobald, 1901b: 159 (*fatigans* ssp.). Type locality: none designated. Location of type(s) (adult) unknown. Synonymy with *fatigans* by Edwards, 1932a: 208.
- pallidocephala** Theobald, 1904: 73. Type locality: Sennar, Blue Nile, Sudan. Holotype female (BM). ? Synonymy with *fatigans* by Edwards, 1941: 316.
- cartroni** Ventrillon, 1905b: 429. Type locality: Majunga, Moroudara, Madagascar. +Lectotype male (MNHP), designated herein (see treatment of *quinquefasciatus* Say). Synonymy with *fatigans* by Edwards, 1932a: 208.
- barbarus** Dyar and Knab, 1906: 210. Type locality: Trinidad. Holotype female (NMNH). Synonymy with *fatigans* by Edwards, 1932a: 208.
- zeltneri** Neveu-Lemaire, 1906, 251. Type locality: Harar and Comboltcha, Ethiopia. Type(s) (male; female) non-extant. Synonymy with *quinquefasciatus* by White, 1975: 322.
- didieri** Neveu-Lemaire, 1906: 257. Type locality: Leopoldville, Belgian Congo. Type(s) (female) non-extant. ? Synonymy with *fatigans* by Edwards, 1932a: 208.
- pygmaeus** Neveu-Lemaire, 1906: 256. Type locality: Imi, Ethiopia. Type(s) (male; female) non-extant. ? Synonymy with *fatigans* by Edwards, 1932a: 208.

- quasilinealis** Theobald, 1907: 415. Type locality: Adelaide, Australia. Type (female) (BM). Synonymy with *fatigans* by Edwards, 1932a: 208.
- stoeuhi** Theobald, 1907: 419. Type locality: British Central Africa. Type (female) (BM). Synonymy with *fatigans* by Edwards, 1932a: 209.
- christophersii** Theobald, 1907: 453. Type locality: India. Lectotype male (BM), designated by Bram, 1967b: 327. Synonymy with *fatigans* by Edwards, 1913b: 55.
- raymondii** Tamayo, 1907 [in Tamayo and Garcia, 1907: 36]. Type locality: Huacachina, Peru. Location of type(s) (male; female; pupa; larva) unknown. Synonymy with *fatigans* by Edwards, 1932a: 209.
- aikenii** Dyar and Knab, 1908: 61. Type locality: New Amsterdam, Surinam. Lectotype male (NMNH), designated by Stone and Knight, 1957: 42. Synonymy with *fatigans* by Edwards, 1932a: 208.
- minor** Theobald, 1908a: 298. Type locality: Sylhet and Lungleh, Lushai Hills, Assam and Calcutta, Bengal, India. Types (male; female) (BM). Synonymy with *fatigans* by Barraud, 1924b: 1264.
- revocator** Dyar and Knab, 1909b: 256. Type locality: Hope Gardens, Newcastle, Jamaica. Lectotype male (NMNH), designated by Stone and Knight, 1957: 55. Synonymy with *quinquefasicatus* by Dyar, 1918: 99.
- lachrimans** Dyar and Knab, 1909b: 259. *Nomen novum* for *aikenii* Dyar and Knab, 1908: 61, *non* Aiken and Rowland, 1906: 34.
- goughii** Theobald, 1911: 268. Type locality: Onderstepoort, Transvaal. Lectotype male (BM), designated by White, 1975: 321. Synonymy with *fatigans* by Edwards, 1913b: 55.
- fuscus** Taylor, 1914a: 699 (*Culicelsa*). Type locality: Townsville, Queensland, Australia. Type(s) ? non-extant. Synonymy with *fatigans* by Edwards, 1924: 395.
- aseyehae** Dyar and Knab, 1915: 112. Type locality: New Providence Island, Bahama Islands. Lectotype male (NMNH), designated by Stone and Knight, 1957: 43. Synonymy with *fatigans* by Edwards, 1932a: 208.
- townsvillensis** Taylor, 1919: 836. *Nomen novum* for *fuscus* Taylor, 1914a: 699, *non* Theobald, 1910c: 319.
- hensemaeon** Dyar, 1920: 178. Type locality: Los Banos, Philippines. Holotype female (NMNH). Synonymy with *fatigans* by Edwards, 1922: 278.
- nigrirostris** Enderlein, 1920: 51 (*fatigans* var.). Type locality: Tananarive, Madagascar. Type(s) (female) (ZM).

APPENDIX D

Complete synonymy of *Culex (Culex) sitiens* Wiedemann

- sitiens** Wiedemann, 1828: 542. Type locality: Sumatra, Indonesia. Holotype female (ZMC).
- impellens** Walker, 1859: 91. Type locality: Makassar, Celebes. +Holotype female (BM). Synonymy with *sitiens* by Edwards, 1913c: 232.
- microannulatus** Theobald, 1901a: 353. Type locality: Quilon, Travancore, [Madras State], India. +Lectotype male (BM), designated by Bram, 1967a: 243. Synonymy with *sitiens* by Edwards, 1913c: 232.
- gnophodes** Theobald, 1903a: 163. Type locality: Bruas, Dindings, [Malaysia]. +Holotype female (BM). Synonymy with *sitiens* by Edwards, 1913c: 232.
- somaliensis** Neveu-Lemaire, 1906: 254. Type locality: Djibouti, Djibouti. Syntypes (male; female) non-extant (?). Synonymy with *sitiens* by Edwards, 1913c: 232.
- nigricephala** Leicester, 1908: 149. Type locality: Batu Gajah, [Perak], Malaysia. Syntypes (male; female) non-extant. Synonymy with *sitiens* by Edwards, 1932a: 204.
- salus** Theobald, 1908b: 256. Type locality: Port Sudan, [Kassala], Sudan. +Lectotype male (BM), designated herein (see treatment of *sitiens* Wiedemann). Synonymy with *somaliensis* by Edwards, 1911: 261.
- jepsoni** Theobald, 1910b: 158. Type locality: Suva, [Viti Levu], Fiji. +Holotype female (BM). Synonymy with *sitiens* by Edwards, 1924: 394.
- saibaii** Taylor, 1912: 28. Type locality: Saibai Island, Torres Strait. Type(s) (female) (US). Synonymy with *sitiens* by Edwards, 1924: 394.
- paludis** Taylor, 1913: 56 (*Culicelsa*). Type locality: Townsville, Queensland, Australia. Type(s) (female) (US). Synonymy with *sitiens* by Edwards, 1924: 394.
- annulata** Taylor, 1914a: 689 (*Culicada*). Type locality: Townsville, Queensland, Australia. Syntypes (male; female) (US). Synonymy with *sitiens* by Edwards, 1924: 394.
- milni** Taylor, 1914b: 196 (*Culicelsa annulirostris* var.). Type locality: Milne Bay, Papua, New Guinea. Syntypes (male; female) (US). Synonymy with *sitiens* Edwards, 1924: 394.
- salinus** Baisas, 1938: 204. Type locality: Caloocan, Rizal, Luzon, Philippines. Type(s) (male, female, larva, pupa) non-extant. Synonymy with *sitiens* by Delfinado, 1966: 152.

CONSPECTUS OF TAXONOMIC CHANGES

Lectotype Designations

<i>albovirgatus</i> Graham, 1910	82
<i>alpha</i> Séguy, 1924	61
<i>auritaenia</i> Enderlein, 1920	92
<i>bifoliata</i> Theobald, 1905c	82
<i>cartroni</i> Ventrillon, 1905b	31
<i>decens</i> Theobald, 1901c	44
<i>dissimilis</i> Theobald, 1901a	82
<i>duttoni</i> Theobald, 1901c	82
<i>hirsutipalpis</i> Theobald, 1901a	82
<i>laurenti</i> Newstead, 1907	48
<i>lividocostalis</i> Graham, 1910	45
<i>madagascariensis</i> Ventrillon, 1905b	92
<i>masculus</i> Theobald, 1901b	44
<i>minutus</i> Theobald, 1905c	44
<i>nigrocostalis</i> Theobald, 1909	44
<i>quasigelidus</i> Theobald, 1903a	92
<i>richteri</i> Ingram and De Meillon, 1927	75
<i>salus</i> Theobald, 1908b	87
<i>simpsoni</i> Theobald, 1905g	75

Neotype Designation

<i>bitaeniorhynchus</i> Giles, 1901a	105
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New Synonymies

<i>alpha</i> Séguy, 1924, synonymy with <i>theileri</i> Theobald, 1903a	61
<i>calloti</i> Rioux and Pech, 1959, synonymy with <i>pipiens</i> Linnaeus, 1758	231
<i>erectus</i> Iglisch, 1977, synonymy with <i>pipiens</i> Linnaeus, 1758	231
<i>ethiopicus</i> Edwards, 1912c, synonymy with <i>bitaeniorhynchus</i> Giles, 1901a	101
<i>mauritanicus</i> Callot, 1940, synonymy with <i>simpsoni</i> Theobald, 1905c	75
<i>torridus</i> Iglisch, 1977, synonymy with <i>pipiens</i> Linnaeus, 1758	231

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